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The Manufacture of Chain Cables.

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One of the most important branches of modern chain manufacture is the production of the heavy cable chains used as anchor chains on vessels, and it is the only branch of this manufacture in which the government has so far interested itself as to prepare certain requirements which must be met by the chain manufacturer in order to have the chain accepted by the government inspectors who pass on all of the material used at the various ship yards. There have been several different sets of requirements compiled which govern the quality of the chain, according to whether the

MAKING $1\frac{5}{8}$ STUD LINK CABLE CHAIN AT THE RATE OF TWELVE FATHOMS PER DAY OR ONE LINK EVERY THREE MINUTES.

chain is for government use, in which case the requirements are quite high, or whether the chain is to be used only on vessels built for and by private concerns, in which case the requirements are easily complied with by the chain manufacturer.

Chain made for private vessels have only to comply with the table of tests and dimensions adopted by the American Ship Masters' Association, compiled principally for the purpose of securing uniform dimensions of link in order that the chain will fit any standard make of windlass. The weight per fathom does not have to be considered; neither does the quality of the iron used, save that of course a fairly good fibrous iron should be used of sufficient ductility and strength as to give satisfactory service. When the manufacturer has gauged the links and subjected the chain to the required proof strain, that is all that is expected.

It is quite another thing to make chain for government use and comply with the rigid requirements of material, weight and test, as called for in making chain for lighthouse vessels, for example. The following extract from the lighthouse board requirements for chain will give an idea of what must be secured in the way of iron:

"The bars must be of homogenous iron and must not contain more than five one-hundredths of 1 percent of carbon nor less than eight one-hundredths nor more than fourteen one-hundredths of 1 percent of phosphorus, nor shall the sum of the carbon and phosphorus be more than fifteen one-hundreds of 1 percent. The iron must not contain more than one-hundredth of 1 percent of sulphur nor more than ten one-hundredths of 1 percent of either silicon or manganese.

"This iron in finished bars must have a tensile strength of not less than 48,000 lbs. per square inch nor more than 52,000 lbs. per square inch, an elastic limit of about 60 percent of the breaking strain, an elongation of at least 30 percent in a length of 8 in. and a contraction of area of at least 40 percent.

"Bolts cut from 1 percent of these bars must stand bending cold until the sides are brought parallel and separated from each other not more than one-half inch without showing signs of rupture. Bolts must also stand bending at red heat until sides are close together without any sign of fracture at the bend. Such bolts as may be nicked and broken cold by slow bending must show fibrous. One percent of these bolts will be made into test specimens of three links and this triplet must stand a pull of at least 39,000 lbs. to the square inch of the sectional area of the link in a 1⅝ in. chain.

"From each chain of 120 fathoms, samples, not exceeding three in number of three links each, will be taken from any part of any shot. These samples will be pulled to destruction at the works or at the nearest standard testing machine under the supervision of an agent of the lighthouse board."

From this it will be seen that not only must a special high grade of iron be secured that will pass the chemical and physical tests of the lighthouse requirements, but also after each 120 fathom shot is made up complete, at least nine links will be cut out to be pulled to destruction and these sample links will, of course, have to be replaced at the manufacturer's expense before the chain is accepted. The breaking strain required by the lighthouse vessel requirements is considerably higher than that required by the American Ship Masters' Association and even higher than that required by Lloyd's Register of Shipping and therefore calls for a chain of high tensile strength and elasticity.

It is evident from the use to which cable chains are placed that the material used in their manufacture must possess peculiar qualities other than superior strength. In addition to possessing good welding qualities the iron must also possess a great deal of ductility and elasticity—the ability to yield slightly to a sudden strain and when that strain is removed, to resume its former condition. A chain made from iron possessing high tensile strength only would be unsuited for cable chain for the reason that while it would resist to a high degree the strain placed upon it, it would in a short time be pulled stiff and thus be worthless for anchor chain use, while a cable chain possessing high tensile strength and elasticity also will give slightly under the sudden strains incidental to its use, but when the strain is removed, will be able to resume its former condition and thus fulfill in a satisfactory manner the use to which it is intended.

In selecting the material from which cable chain is to be made it is advisable to subject samples thereof to tests in order to determine whether or not the quality of the material is as desired.

Most iron, unless especially rolled from selected material, is liable to be either "red short" or "cold short," and it is well to test samples of iron for both. "Red short" iron is iron that will crack when worked at a heat, and is caused from too much sulphur in the ore. In order to test for "red short" iron it is usual to heat the sample bar at the end, open the end and bend the horns back upon themselves. If this can be accomplished without sign of crack or flaw the iron is free from too much sulphur. In order to test for "cold short" iron the sample bar should be bent double on itself while cold, and if this is accomplished without sign of crack or flaw, the iron is free from too much phosphorus, which causes the iron to be "cold short." Another and probably the best way to test for "cold short" iron is to nick the sample bar with a chisel and bend it back upon itself. This will fracture the iron and show the fibre, which in good iron will be long and tough and of a dark grey color. Iron which may show traces of being "cold short" may still be acceptably used for the manufacture of chain cables for the reason that the iron is always at a red heat while the chain is in the process of manufacture, but for the purpose of insuring the most satisfactory quality of product, it is better to use an iron that pases both tests satisfactorily.

Leaving the subject of material, which is of the highest importance on account of the valuable lives and property dependent thereon, we come to the subject of forming this material, link by link, into the long cable chain.

The mention of chain occurs in history as far back as our records go and even in the Bible mention was made of chain, although there is nothing shown in the old records to enable us to determine the shape of the links or the material from which they were made. From the nature of the product and its many uses it is safe to argue that chain is an ancient institution dating back to the first use of iron in any shape.

While modern methods and machinery have so developed the industry that the old and the new processes of manufacture have little in common, yet the main feature of each process still remains the raising of the material to a welding heat and effecting a homogeneous union by pounding the ends together.

All chain used for ship cables is strictly hand made chain, sometimes called "off the rod" chain, from the fact that the material is cut off of the long rod, bent into shape and welded by blows of hand hammers and sometimes called "dolly" chain, from the fact that after the weld has been accomplished by means of blows of the hand hammers, the weld is smoothed under a "dolly" in order to reduce the swell of the weld to the same size as the balance of the link and also to remove the marks left by the hammer blows. For the purpose of illustrating in detail the successive steps incidental to the manufacture of ship cable chain, taking each operation step by step from the cutting of the long bar into pieces to the finishing touches placed on the completed

chain, we reproduce herewith a photograph showing the manner in which 1⅝ in. stud link cable chain is made. The chain-maker can be seen holding the link of chain in his tongs, while his two helpers are smoothing up the weld by means of hammer blows on the head of the dolly. The chain-maker and his helpers can, in the usual eight-hour day, turn out about twelve fathoms per day, equal to about 1,800 pounds and at the rate of one link welded every three minutes.

From the long bar of iron pieces are cut on a power shear to a predetermined length so that each piece is the proper length to make one link of the chain. These pieces are placed in the fire at the opening shown at the right side of the fire, where an inclined rack is shown, on which the pieces are laid so that they are being slowly heated by the waste heat of the fire. The lowest piece on this rack is withdrawn from the front of the fire with large tongs and placed down in the glowing bed of the fire, where it is quickly brought to a red heat. When this heat is reached, the piece is withdrawn, while another piece of iron is taken from the rack and placed in the fire in its stead. The first piece is now placed in the link bending machine which stands near the fire and by means of a long arm operated by the helpers the piece is bent around a link former or mandrel into a U shape. This U-shape link is now placed back in the fire for reheating and in the meantime another piece is bent into U shape, these operations being successive and timed with exact precision. Owing to the fact that iron at a high temperature scales rapidly when brought into contact with the air, it is customary to take some steps to prevent this scale forming on the part of the link that is being welded. For this purpose, when the iron having reached a white heat, is withdrawn from the fire, the open ends are first dipped in a pan of sand conveniently near, hooked through the last link welded and placed on the face of the anvil. The helpers now pound one end of the link with their hammers until it has been tapered down to an angle of 60 percent with the diameter of the bar, and when one end is thus drawn down or "scarfed," as it is called, the link is turned over and the other end scarfed in a like manner. The union of the sand and scale form a sort of liquid slag which is expelled by the blows of the hammers, leaving the scarfs clean and free to weld. On the side of the anvil towards the chain-maker is the beck-horn which has its face hollowed out to receive the link, and on the opposite side of the anvil, through which the beck-horn projects, is attached a dolly, which is hinged to the projecting end of the beck-horn in such a manner that when the dolly is lowered the groove in the under part of its head will meet the groove in the beck-horn.

After the ends of the link have been scarfed out, during which time the dolly is swung back out of the way, the link is placed against the beck-horn while the ends of the link are pounded towards each other in such a way that the ends, being scarfed in opposite directions, will meet and form the continuity of the link. The link is then placed flat on the face of the anvil and the scarfed ends pounded tightly together and the link then placed back in the fire for the final and welding heat. When this has been reached, the link is again withdrawn, the end to be welded placed flat on the face of the anvil while the helpers with their hammers pound the scarfed ends together, thus welding the ends of the link at the point of contact. The link is then placed in the groove of the beck-horn, the hinged dolly lowered to rest on the top of the welded portion, while the helpers pound the top of the dolly with their hammers as the chain-maker moves the link backwards and forwards on the beck-horn, at times turning the link entirely over so that all portions of the weld secure a thorough working necessary to insure a perfect weld.

The link is then placed on the face of the anvil while a cast iron stud is inserted in the center of the link, the link being narrowed by hammer blows to grip and hold the stud in place. These studs have their ends hollowed out to correspond with the rounded surface of the link and are used for the purpose of increasing the strength of the link and for preventing the link narrowing when subjected to a strain, as would a similar unstudded chain. The placing of the stud in the center of the link increases the strength of the chain one-third and the proof and breaking tests of stud link cable chain are one-third higher than chain of the same size, made close link and without studs.

After a shot of chain has reached the proper length it is fitted with end links and then subjected to the required proof strain, during which the links are gauged to see that they are of proper dimensions to fit in the windlass for which they are made. After the testing the chain is dipped in a vat of blacking in order to protect it from rust while in transit and is then ready for shipment.

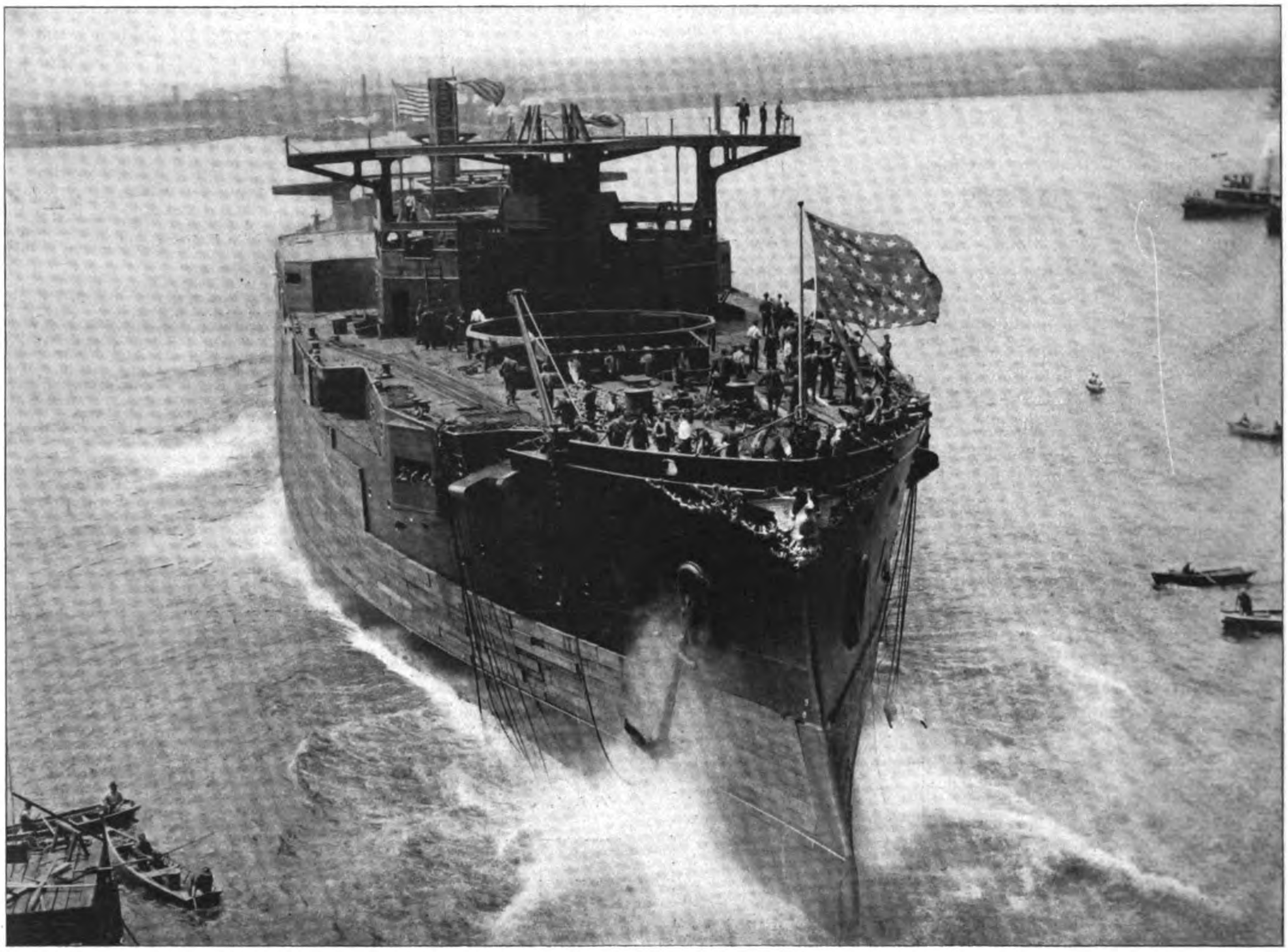
The fires in which the links are heated are of an ordinary brick type and the fuel used is a 24-hour coke, which is crushed to certain sizes according to the size of chain to be made. Artificial draft or blast is forced into the fire in order to maintain the high temperature required, this blast entering the fire from one side and being brought up into the body of the fire through a water cooled tuyere, which consists of a conical cast iron piece with a hole through its center through which the air passes. The air passage is encircled by a chamber containing flowing water which prevents the tuyere being burnt out by the intense heat of the fire. The blast entering the fire naturally results in part of the

TABLE OF TESTS AND DIMENSIONS OF LINKS OF STUD LINK CABLE CHAIN.

Size of Chain Inches.	Requirements of American Ship Masters' Association. Dimensions of Links. Outside Length Inches	Outside Width Inches	Weight per fathom, lbs.	Proof Test in Tons.	Requirements of Lloyd's Register of Shipping. Length in Fathoms.	Proof Test in Tons.	Breaking Test in Tons.
⅞	5	3¼	49	13¾	165	13¾	20⅝
1	5⅞	3¾	61	18	165	18	27
1⅛	6½	4⅛	74	22 4-5	195	22¾	34⅛
1¼	7⅛	4½	90	28 1-10	210	28 1-10	42⅛
1 5-16	7⅜	4⅝	97	31	210	31	46½
1⅜	7¾	4⅞	110	34	210	34	51
1 7-16	8⅛	5⅛	113	37 1-5	210	37⅛	55⅝
1½	8½	5⅜	127	40½	210	40½	58 7-10
1⅝	9¼	5⅞	150	47½	240	47½	66 5-10
1¾	10	6¼	173	55 1-10	240	55⅛	77⅛
1⅞	10½	6¾	203	63 3-10	240	63¼	88 5-10
1 15-16	10¾	7	215	67½	270	67½	94½
2	11⅛	7¼	233	72	270	72	100 8-10
2⅛	12	7¾	276	81¼	270	81¼	113¾
2¼	13	8¼	300	91	270	91⅛	127½

flames and heat being forced out the front of the fire against the workmen and in order to counteract this, it is necessary to provide large fans which are suspended over the workmen and operated from the shafting of the shop.

As the strength of a chain is that of its weakest link, so is the strength of a link that of its weakest point, which is invariably in the weld. Notwithstanding the care taken in forming a weld it cannot be relied upon until given the test of continued usage and it is an acknowledged fact that by being welded the chain link loses 50 percent of its theoretical strength—in other words, a chain link being formed by the union of its two sides should possess twice the strength of one side, but this is not the case, as repeated tests have shown that the strength of a welded link is only that of the single bar of material, instead of that of double the bar, as might be expected. A test made of a great number of welded stud links shows that over 75 percent of the breaks occurred at or near the weld, which proves conclusively that the welds were not homogeneous. This weakness is due in part to the repeated working of the material at the welded juncture de-



LAUNCH OF BATTLESHIP KANSAS AT THE YARD OF THE NEW YORK SHIP BUILDING CO., CAMDEN, N. J.

[For description see *Marine Review*, *August 17*.

stroying the fibre of the iron and in part to the fact that the iron was either just a little too high or a little too low in temperature to afford the opportunity of securing a perfect and homogeneous union at that point.

Government inspection of vessels, both while building and after in use, does much to reduce to a minimum the chances of accidents occurring through defective chains and as often the safety of a huge vessel, with its precious cargo of human lives, is dependent upon the quality of material and weld of the anchor chain, such inspections cannot be too rigid.

METEOR, NOW NELSON BLOOM

The Meteor, the queen of the lakes in the early sixties, took out a cargo of lumber from Ontonangon last week. Her name has been changed to the Nelson Bloom and she has had a spectacular career. No one would recognize the present craft as once having been the trimmest and fastest passenger and packet boat which plied these waters.

Many remember the Meteor. She was a two-wheel propeller and was built at a cost of $110,000. She was launched in 1863 and ran between Cleveland and the head of the lakes. She was owned by J. T. Whiting & Co., of Detroit, and her handsome appearance and speed attracted much attention.

The Meteor's collision with the Pewabic in Lake Huron in 1865 is still vivid in the memories of many of the old time residents. One boat was bound up and the other down. They went together in the early evening with full steam. The Pewabic was sunk and many lives were lost. The Meteor was damaged only slightly. She was in charge of Capt. Thomas Wilson, and the Pewabic was commanded by Capt. George McKay, who is still living at Cleveland. Both were experienced sailors and what caused the collision is one of the unsolved mysteries. Shortly afterward the Meteor was sold at admiralty sale and was bid in by Mr. Mason, who was at that time president of the Quincy mine.

About a quarter of a century ago the Meteor was burned while lying at dock at Detroit. A few years later the hull was purchased and was rebuilt into a sailing craft, and named the Nelson Bloom. During the past seven or eight years she has been used almost exclusively as a tow barge, although she still carries a full canvas rigging, which is brought into use occasionally.

The Nelson Bloom is owned by Harrow, Lozen & Baker and is in charge of Capt. J. P. Harrow, who has sailed the lakes since 1857.

The Norwegian collier Tricolor, which went ashore with a cargo of coal near Cape Mendocino, Cal., on July 24, has been abandoned by the underwriters. Lloyds' surveyor (Captain John Metcalfe) and James Dickie having reported that the place where she lies is so rocky that any attempt to save her would be futile. The surveyors were taken on the tug Ranger to a spot about half a mile from the vessel, which they tried to board from a life-saving boat, but heavy seas rendered this impossible. The underwriters will not even try to save any of the machinery. The Tricolor cost about $300,000 and is hardly a year old.

SOLID BULKHEADS VS. WATERTIGHT DOORS

This is a subject which is now, more than any other, agitating English naval engineers and the authorities at Whitehall as well as the technical and newspaper press of Great Britain. On one side of the controversy are those who would do away with bulkhead doors altogether, and on the other those who would not avoid one difficulty by rushing into another.

Everyone realizes that the weakness of the bulkhead systems of warships and the great passenger liners is that they have many bulkhead doors which sad experience proves are likely to be left open when it is most necessary that they should be closed. The party of the first part, referred to above, a leader among which is Vice Admiral Lord Charles Beresford, believe that the way to repair the weak spot in the bulkhead system is to close up all the doors, ignoring the fact that openings are absolutely necessary to efficiency in the working of the ship and to afford means of escape from one compartment to another. But the party of the second part, by far the larger party of this controversy, favor a solution, not an avoidance of the problem.

Every British technical journal of recent date and a great many newspapers which devote serious attention to naval and marine engineering topics give evidence that this problem of solid bulkheads or watertight doors is a growing one, and that it has gone too far before the eyes of the public to admit of anything less than a rational and finally satisfactory solution. The admiralty minute upon the Victoria disaster is, in nine cases out of ten, drawn upon for evidence that bulkhead openings are not necessarily a source of weakness, but become so by the fact that the proper provision is not made for the closing of these openings in time of danger. Over and over again is printed the dictum of "their lordships" that "the general structural arrangements of the Victoria with the arrangement of watertight doors, armor belt, and protected deck, did not by any fault of principle contribute to the loss of the ship; but that, on the contrary, had the watertight doors, hatches and ports been closed, the ship would have been saved, notwithstanding the crushing blow which she received from the Camperdown." To this one able expert adds, and in doing so he voices a majority opinion, not only of the men who write about ships, but those who officer them, that "what was true twelve years ago is equally true in principle to-day, while scientific progress has served to make its application more effective than ever. There is as little prospect of watertight bulkhead doors being abolished in our warships, as there is of armor belting being done away with."

Another writer in a technical journal tells us that "their lordships have decided to do away, *as far as possible,* with all watertight doors in the athwartship bulkheads of battleships and cruisers of late design, including the Minotaur now building. This important modification has, of necessity, led to a reconsideration of the means of egress and ingress between the main compartments, and as a solution of this difficulty it has been definitely decided to install lifts wherever possible. This innovation is likely to prove both convenient and useful, as, owing to the great depth of hold in our latest type of warships, ladders would be as much out of place in them as stairways would be in our lofty hotels."

That the closing of all bulkhead openings and the installation of lifts as a means of ingress and egress to the compartments should have been received with derision is not remarkable, and those who do not deride the idea take pains to point out that the admiralty is removing one complication and adding another which will probably give rise to greater difficulties than those encountered in the operation of the doors.

A few writers come out plainly, and severely berate the admiralty for dodging the whole problem instead of casting about for a solution of its perplexities. One of these reminds the authorities at Whitehall that while they are considering the abolition of means of communication between the compartments, the American navy has found a way out of its difficulty by adopting electrically operated bulkhead doors. In other words, the American designer instead of reducing the importance of the doors has augmented their importance. He saw that the old bulkhead door was a source of weakness and proceeded to find a better door; he has never seriously considered doing away with the doors altogether. He has increased the rank of the bulkhead door to that of an important factor in maintaining the safety and efficiency of a warship at all times, and under all circumstances.

It certainly seems most inopportune at this time when a satisfactory power door has just been evolved to talk of doing away with bulkhead openings altogether because the obsolete bulkhead door is unsatisfactory. To advocate that no doors shall be used precisely at the moment when a safe door has completed its practical evolution and development and has withstood the hard test of actual use aboard ships, is, indeed, somewhat more than inopportune—it is almost ridiculous.

Ship designers have before this decreed that vessels should be built without bulkhead doors. Then the men who had to go to sea in such ships and who were responsible for working them arose and protested until the doors were restored. They found that means of communication from compartment to compartment were absolutely necessary, and so these doors, the weakness of which was all the time acknowledged, continued to be used, and it is a safe prophesy that the time when all openings in bulkheads will be done away with is afar off.

It will be a matter for legitimate pride and satisfaction in America if the English naval designer adopts the way out of his perplexities which his American brother has found in the adoption of the so-called "long-arm" system of electrically operated bulkhead doors and armor hatches. This system is now in operation on or under contract for thirty-two of the newest and most powerful ships in the United States navy, including the cruisers and battleships of the Colorado and Montana type. "It will be interesting to know," remarks the naval expert of the *Western Morning News* of Plymouth, England, "whether the authorities at Whitehall have seriously taken into consideration the solution of the problem which has recommended itself to the navy department at Washington. The authorities of the United States navy appear to be more completely impressed in favor of the "long-arm" system year by year, and it would not be surprising if the present board of admiralty did not strictly investigate its claims before embarking upon a method of subdivision which can not fail to lead to great inconvenience, and might in certain circumstances be inimical to safety owing to the impossibility of getting from one compartment to another and insuring satisfactory ventilation."

It is apparent fom the merits of the case, as well as from this and other samples of the manner in which British naval exports treat the subject, that the admiralty will have a hard time convincing the public that the way out of its bulkhead door perplexity is to close up these doors altogether instead of adopting a system of mechanical power-doors that, as the expert just quoted remarks, has proven more satisfactory in our navy year by year.

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There are twenty-two ships under order in great lakes shipyards for delivery next year. With the single exception of one steamer of 6,500 tons, these twenty-two ships are of the larger class, four of them capable of carrying 8,000 tons, three 9,000 tons, two 9,500 tons and twelve 10,000 tons and over. To this list must be added some twenty-one ships that were under order at the beginning of the year, having a carrying capacity of from 8,000 to 10,000 tons, making a total of forty-three ships which will be ready for next year's business, with a carrying capacity on a single trip of 397,500 tons, or in an average season of twenty trips, of 7,950,000 gross tons of ore. This is more ore than was carried down the lakes during the full season of 1894, just a little more than ten years ago. Consider what these orders mean to the general industry of the United States. In what manner could work be more widely distributed. A ship is a continuous contribution to labor from the moment the ore leaves the ground until it is worked into the various parts of the vessel. No single product of mankind calls for such diversified employment, for it brings into play a great variety of energy. When these ships go into commission 90 percent of their actual value will have been distributed among the workmen of the United States. It means a continuous and active circulation of money, in other words, prosperity.

It is interesting to observe that the North German Lloyd Steamship Co. has just placed an order for a duplicate of the Kaiser Wilhelm II. The Kaiser Wilhelm II was built for the express purpose of relieving the Deutschland, of the Hamburg-American line, of her laurels as the fastest steamship afloat. The Deutschland has an engine power of 36,000 H. P., and has been able to maintain a speed of 23 knots. The Kaiser Wilhelm's engine power is 4,000 in excess of this, but her speed is virtually no greater than that of the Deutschland. Under favorable conditions she can make a trifle better time than the Deutschland, but it is so small as to be of no practical use in the time from dock to dock. Whether the duplicate of the Kaiser Wilhelm will be given greater engine power is not as yet known, but it is known that she will be equipped with reciprocating engines. This is especially significant in view of the fact that the Cunard line is now building two turbine steamers designed for 25 knots. Evidently the North German Lloyd Co. is not impressed with the practicability of the turbine for ocean service. British builders, however, are utilizing this form of engine in a variety of ways and recently conducted some experiments with a turbine-driven Channel steamer to show that it could be stopped and backed as quickly as any other.

Very few people realize that the commerce of the great lakes passes through an artificial waterway which is nearly five miles longer than the proposed artificial waterway across the isthmus of Panama. There are nearly forty-five miles of dredged channels from the head of the lakes to Lake Erie, meaning artificial waterways constructed by the government for the passage of vessels. The money expended, however, has been well worth while. The annual sum saved in transportation charges on shipments from the head of the lakes alone is greater than the total amount expended by the government on the great lakes since the navigation of them begun. No better investment can be made by the general government than the improvement of waterways. They must serve forever as a leveler of rates and the cheapness of transit afforded by them must inevitably inure to the benefit of the whole people.

Elsewhere in this issue is given the chronology of the installation of machinery in the steamer Powell Stackhouse at the Orleans street yard of the Detroit Ship Building Co. Certainly no such expedition as this has ever hitherto been obtained on the great lakes, and it would be interesting to know whether foreign shipyards are capable of equaling it. This particular

yard has special opportunities for dispatch in handling machinery, owing to its magnificent river frontage; and in addition it has the advantage of a thoroughly disciplined personnel. The various heads of departments in the machine shop have been there for twenty years or more. They are rapid and excellent workmen and rose splendidly to the test.

Lake Superior has not for many years been visited by a storm of such violence as that which marked the storm of last week. For several days preceding this great storm the lake had been as smooth as glass, but it is well known to navigators that this body of water is subject to violent disturbances. Only the stoutest crafts were able to weather the gale in safety. The list to date shows that four vessels have been lost with forty members of their crews. The aftermath may reveal something more, as one of the little islands in the path of the storm was entirely submerged.

HEAVY ORE SHIPMENTS

Ore shipments have again been delayed by the excessive rains in the Lake Superior country which have flooded the Mesabi mines and prevented the movement of ore to upper lake docks. Notwithstanding this handicap, however, there were moved on the great lakes during August 4,996,930 tons of ore, as against 4,011,584 tons for August of last year. The movement up to Sept. 1 of the present year is 21,035,604 tons, as against 11,419,608 tons up to Sept. 1 of last year. There are still two months left wherein favorable weather may be expected and it is almost certain that 10,000,000 tons will be shipped between Sept. 1 and the close of navigation. This will cause the total ore movement to exceed 31,000,000 tons for the year. The movement is being handled almost exclusively by contract vessels, shippers having really all that they can do to supply their contract tonnage. In fact, vessels are rather badly bunched at upper lake docks, owing to the limited movement from the mines. Following are the shipments by ports during August and for the season up to Sept. 1. For purposes of comparison the corresponding period for last year is also given:

	August.		To September.	
	1904.	1905.	1904.	1905.
Escanaba	711,756	706,252	1,698,308	3,227,865
Gladstone	......	......	480	......
Marquette	366,172	421,685	818,010	1,882,211
Ashland	389,043	501,184	967,969	2,148,351
Superior	865,090	1,433,556	2,148,919	5,589,491
Duluth	865,090	1,433,556	2,148,919	5,589,491
Two Harbors	872,245	1,233,256	2,065,833	5,019,660
	4,011,584	4,996,930	9,615,996	21,035,604
1905 increase		985,346		11,419,608

Mr. Wm. Randolph Strickland has resigned from the New York Central railroad and is now associated with J. G. White & Co., 43 Exchange Place, New York, as assistant to the secretary. Mr. Strickland is a graduate of the Massachusetts Institute of Technology and during the Spanish-American war served at the Mare Island navy yard as assistant engineer. Mr. Strickland made the hydraulic calculations for the North Fork power house at Denver, Colo., in 1900. After he had completed this work he joined the staff of the Colorado Fuel & Iron Co. as engineer of location on a standard gauge line over McClure Pass.

CONTRACTS FOR MORE FREIGHTERS

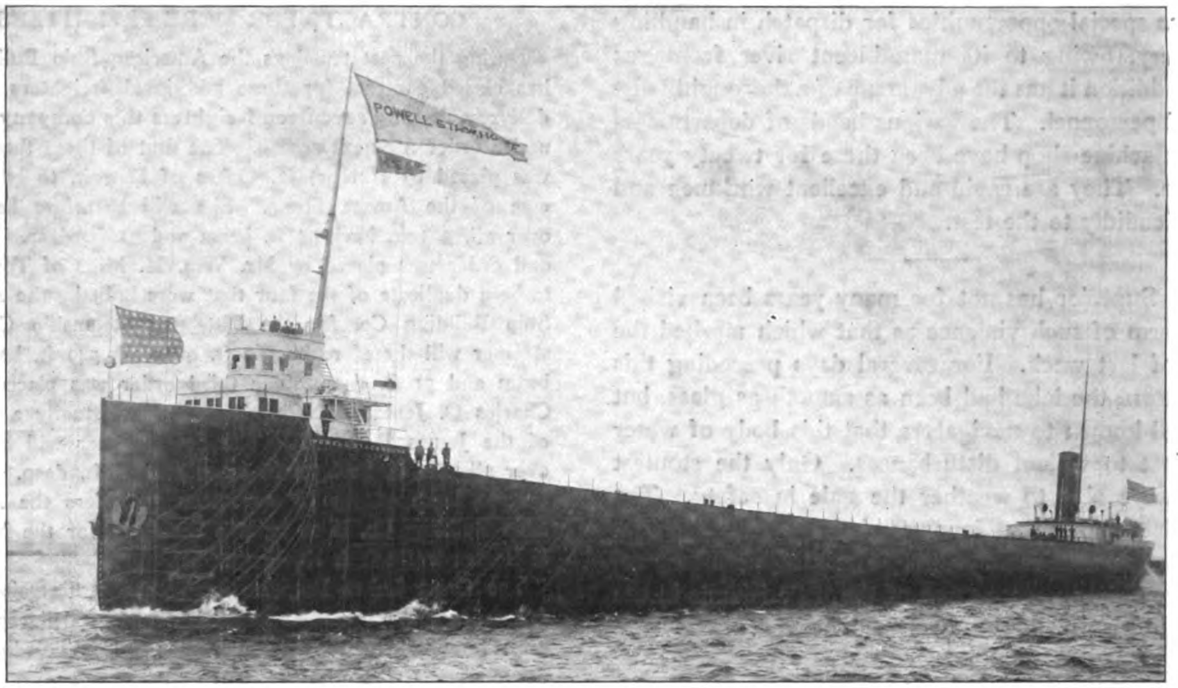
During the past ten days the American Ship Building Co. has closed contract for three additional freighters for 1906 delivery, making seventeen freighters this company now has under order for next season. The first of these three orders was placed by Herbert H. Oakes of Detroit, to be a duplicate of the Amasa Stone. She will therefore be 545 ft. over all, 525 ft. keel, 55 ft. beam and 31 ft. deep. The second order was placed by Mr. Wm. M. Mills of Tonawanda, to be a duplicate of the four that were built by the American Ship Building Co. for the Pittsburg Steamship Co. This steamer will therefore be 569 ft. over all, 549 ft. keel, 56 ft. beam and 31 ft. deep. The third order was placed by Mr. Charles O. Jenkins of Cleveland, to be virtually a duplicate of the James P. Walsh. The new steamer will be 500 ft. over all, 480 ft. keel, 52 ft. beam and 30 ft. deep. In addition to these orders for seventeen freighters the American Ship Building Co. is to build a car ferry for the Marquette & Bessemer Dock & Navigation Co.

The Great Lakes Engineering Works at Detroit has under order four 10,000-ton steamers for 1906 delivery, besides a car ferry, and the Craig Ship Building Co., Toledo, has under order an 8,000-ton steamer.

The era of the big ship may be said to have begun with the construction of the Augustus B. Wolvin in 1904. The Wolvin was the first 10,000-ton ship to be built on the great lakes. The Wolvin is 560 ft. over all, 540 ft. keel, 56 ft. beam and 31 ft. deep. The following table will show with what rapidity owners have followed the lead set by Mr. Wolvin. Following is a list of big ships that have been constructed or are now under order for construction since the Wolvin was built. It will be seen that they number forty-three, with carrying capacity on a single trip of 397,500 gross tons of ore, or 7,950,000 tons in an average season of twenty weeks:

NAME	Over all Length Feet	Keel Feet	Beam Feet	Depth Feet	Year Built	Capacity Gross Tons	OWNER	
Ball Bros.	500	480	52	30	1905	8,000	G. A. Tomlinson,	Duluth
Jas. C. Wallace	552	532	56	31	1905	10,000	Acme S. S. Co.	"
S. M. Clement	500	480	52	30	1905	8,000	Mitchell & Co.	Cleveland
Philip Minch	500	480	52	30	1905	8,000	H. Steinbrenner,	"
Amasa Stone	545	525	55	31	1905	10 000	Pickands Mather,	"
L. C. Smith	545	525	55	31	1905	10,000	U. S. Trans. Co.,	"
Sylvania	524	504	54	30	1905	9 000	G. A. Tomlinson,	Duluth
Socapa	524	504	54	30	1905	9,000	G. A. Tomlinson,	"
W. A. Rogers	545	525	55	31	1905	10,000	Niagara Trans. Co.	"
L. C. Hanna	524	504	54	30	1905	9,000	M. A. Hanna & Co.,	Cleveland
P. Stackhouse	524	504	54	30	1905	9,000	M. A. Hanna & Co.,	"
Wm. A Paine	500	480	52	30	1905	8,000	Hutchinson & Co.,	"
E. H. Gary	569	549	56	31	1905	10,000	Pittsburg S. S. Co.,	"
W. E. Corey	569	549	56	31	1905	10,000	Pittsburg S. S. Co.,	"
G. W. Perkins	569	549	56	31	1905	10,000	Pittsburg S. S. Co.,	"
H. C. Frick	569	549	56	31	1905	10,000	Pittsburg S. S. Co.,	"
J. E. Davidson	524	504	54	30	1905	9,000	G. A. Tomlinson,	Duluth
Hoover & Mason	524	504	54	30	1905	9,000	G. A. Tomlinson,	"
W. G. Mather	531	511	60	31	1905	10,000	Cleveland Cliffs I. Co .	Cleveland
Peter White	524	504	54	30	1905	9,000	Cleveland Cliffs I. Co.,	"
Jas. P. Walsh	500	480	52	30	1905	8,000	C. O. Jenkins,	"
Un-named	524	504	54	30	1906	9,000	C. L. Hutchinson,	"
"	524	504	54	30	1906	9,000	Wilson Transit Line	"
"	545	525	55	31	1906	10,000	C. L. Hutchinson,	"
"	545	525	55	31	1906	10,000	John Mitchell,	"
"	545	525	55	31	1906	10,000	John Mitchell,	"
"	436	416	50	28	1906	6,500	John Mitchell,	"
"	534	514	54	31	1906	9,500	Gilchrist Trans. Co.,	"
"	534	514	54	31	1906	9,500	Gilchrist Trans. Co.,	"
"	500	480	52	30	1906	8,000	Hugh McMillan,	Detroit
"	524	504	54	30	1906	9,000	E. D. Carter,	Erie
"	500	480	52	30	1906	8,000	W. C. Richardson,	Cleveland
"	550	530	56	31	1906	10,000	Jones & Laughlin,	Pittsburg
"	550	530	56	31	1906	10,000	Jones & Laughlin,	"
"	550	530	56	31	1906	10,000	Globe S. S. Co.,	Duluth
"	550	530	56	31	1906	10,000	W. P. Snyder & Co.,	Pittsburg
"	505	485	56	31	1906	8,000	L. O. Sullivan,	Toledo
"	545	525	55	31	1906	10,000	H. A. Hawgood,	Cleveland
"	569	549	56	31	1906	10,000	U. S. Trans. Co.,	"
"	545	525	55	31	1906	10,000	Hawgood & Co.,	"
"	545	525	55	31	1906	10,000	Herbert H. Oake,	Detroit
"	569	549	56	31	1906	10,000	M. M. Mills,	Tonawanda, N. Y.
"	500	480	52	30	1906	8,000	C. O. Jenkins,	Cleveland

Total in one trip 397,500
Total in a season of twenty trips 7,950,000



THE STEAMER POWELL STACKHOUSE.

Rapid Installation of Machinery.

The installation of machinery into the steamer Powell Stackhouse at the yard of the Detroit Shipbuilding Co. marks a record for despatch which has never hitherto been attained on the great lakes. The Stackhouse was launched at Wyandotte at 11 a. m., Aug. 5. Tow lines were already attached to her and she started for the machine shop at the foot of Orleans street in Detroit immediately, arriving there at 2:30 p. m. Three hours later, or at 5:30 p. m., the boilers were landed in the ship. The daily chronology of progress thereafter is extremely interesting. No work, of course, was done on Sunday.

Monday—Hoisted in first, upper breeching, Ellis & Eaves fan; second, ash elevator legs, air pumps and condenser; driving bearing and intermediate shaft, main engine; set engine and boilers and got the template for main steam pipe Monday afternoon and put boiler house deck on and bolted up.

Tuesday—Hoisted in steel spars, stack, pistons and cylinders; finished hoisting in of the machinery, connected up main steam pipe, main and auxiliary feed pipes, auxiliary steam and exhaust pipes; drilled all the holes for holding down bolts for main engine.

Wednesday—Filled the boilers in the forenoon and had preliminary test. At 3 p. m. the United States inspectors inspected the boilers.

Thursday—Finished riveting up the boiler house, started a fire and raised steam. Finished bolting down the main engine.

Friday—Screwed up the joints around boiler and engine, put on cups, etc.; started main engine at 1 p. m. under steam and worked it for three hours at a good stiff gait until satisfied it was ready for sea. Forty-eight working hours only were consumed in installing the boilers and engines and having machinery running smoothly under steam. As soon as the engine was stopped Friday it was cleaned thoroughly, ready for painting.

The fact that the company succeeded in putting the boilers in on the day of the launch made it possible to work the engine on Friday or a day ahead of the time in which it was planned to work her. The work was all prearranged and nothing but an unforeseen accident could have prevented the company from doing it in the time planned. Absolutely nothing was left to chance. Everything was in readiness, the machinery being on dock in the relative position that it would occupy on board ship and the workmen moved with clock-like regularity not to miss a single moment. Supt. C. B. Calder, under whose supervision the work was done, says that the performance is to be credited purely to the organization of the personnel. Many of the heads of departments of this company have been continuously there for a quarter of a century or more and are skilled and rapid workmen. Supt. Calder gives especial credit to W. G. Henderson, foreman of the machine shop, who has been in the company's employ for twenty years or more; to John Chambers, steam fitter and plumber; to Robert Gray, sheet metal worker; to Hugo Betzold, boiler maker; to Fred Ritchie, who installed the steering gear and hatch fasteners; to James Hunter, who erected the engine in the boat; to John Fitzgerald, an excellent workman, who hoisted the machinery into the boat, and Mr. William Robinson, who was sent up from Cleveland by the American Shipbuilding Co., to act as foreman on cabin work. Supt. Calder says, however, that there were others quite as deserving of special mention as these, and spoke with pride of the fact that even the humblest employee on the dock was imbued with the spirit of the occasion.

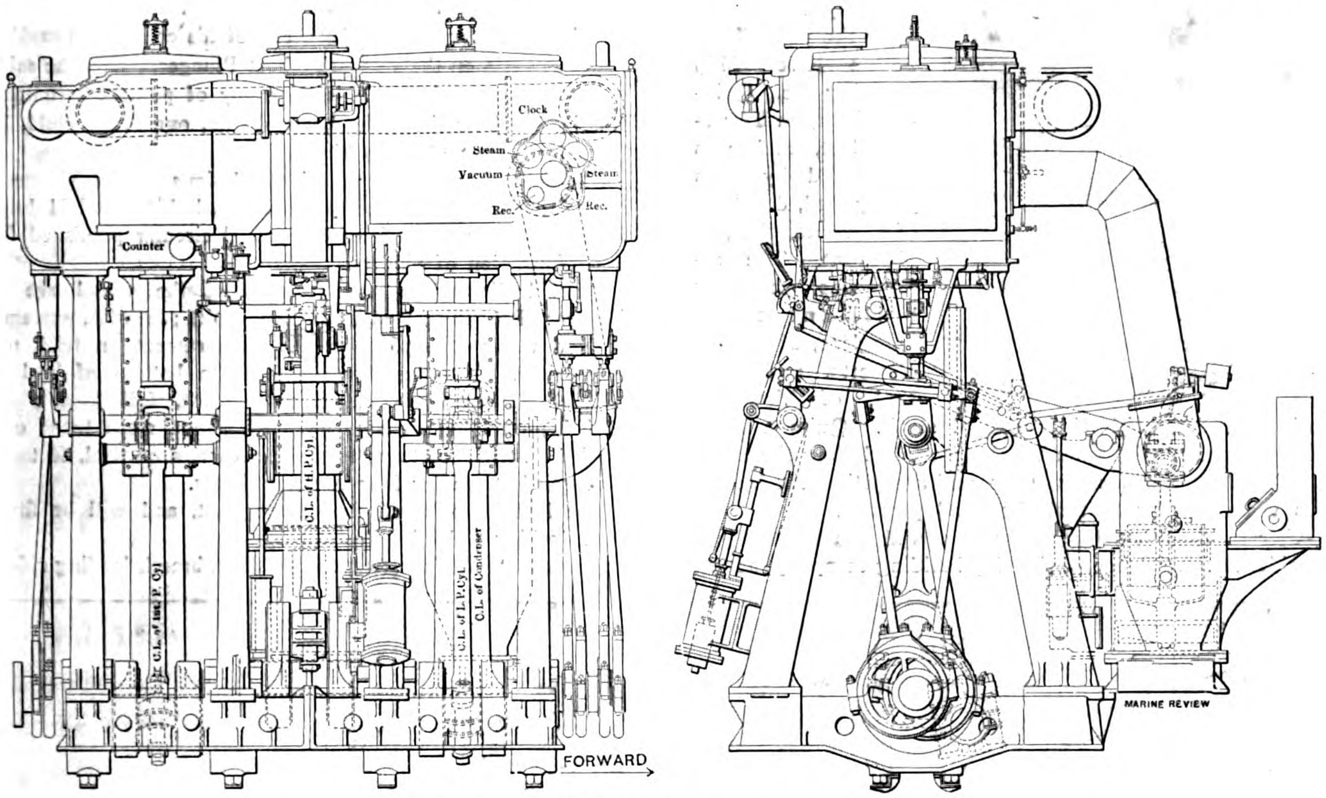
It was exactly 113 working hours from the time the Stackhouse was launched until she was furnished and ready for sea. The machinery was completely installed during the first week, the second week being spent in testing the water bottom tanks, in finishing up the joiner work, in painting and putting in furnishings.

This record of fourteen days is not likely to be excelled by any other yard, as the Wyandotte yard has exceptionally good facilities for despatch. As a matter of record it may be noted that it was forty-one days after the W. A. Paine was launched before she went into commission; the Corey, 49 days; the Sylvania, 60 days; the Socapa, 44 days; the

Amasa Stone, 43 days; the L. C. Smith, 21 days; the Phillip Minch, 57 days; the W. A. Rogers, 30 days; the L. C. Hanna, 51 days; as against 14 days for the Stackhouse.

and 20 minutes, or at the rate of 12.4 knots an hour, the machinery working throughout with absolute precision.

The engines of the Stackhouse are of 2,000 h. p., the cylin-



ENGINES OF THE STEAMER POWELL STACKHOUSE.

The Stackhouse could have left Detroit on her maiden trip on Aug. 19, on which day she was turned over to her crew. She left, however, on Aug. 20, being held for her owner who

der diameters being 23½, 38 and 63 in. x 42 in. stroke, supplied with steam from two boilers 14 ft. 6 in. diameter and 12 ft. long, allowed 180 lb. pressure and fitted with Ellis &

BOILERS OF THE STEAMER POWELL STACKHOUSE.

had thought of making the initial trip on her but changed his mind later. The steamer on her initial trip covered the distance between Port Huron and Sault Ste. Marie in 22 hours

Eaves induced draft. The propeller is 14 ft. 3 in. in diameter and 14 ft. 6 in. pitch; revolutions per minute, 85. The weight of the machinery is 325 tons.

LAUNCH OF BATTLESHIP VERMONT

MISS BELL SMASHES THE BOTTLE.

The battleship Vermont was successfully launched from the yard of the Fore River Ship Building Co., Quincy, Mass., on Thursday last, and was christened by Miss Jenny Bell, daughter of Governor Bell, of Vermont. The affair was unusually brilliant as Gov. Douglass, of Massachusetts, and Gov. Bell, of Vermont, both attended with their official staffs. Quite a delegation also attended from Washington, including the naval attaches from various countries, and altogether the launch was witnessed by several thousand persons.

After the launch a luncheon was served in the mold loft, President F. T. Bowles, of the ship building company, acting as toastmaster. He paid a great compliment to the sons of Vermont who had been in the navy, and hoped that the future officers of the battleship would be worthy successors of Capt. Clark of Oregon fame. Brief speeches were made by Gov. Douglass and Gov. Bell. Admiral Bowles proposed a toast to President Roosevelt which was received with the wildest applause. Assistant Secretary of the Navy Darling also in a speech referred to the president and spoke of his part in the victory of San Juan and of his courage in making the recent trip on the submarine boat Plunger. Then he said:

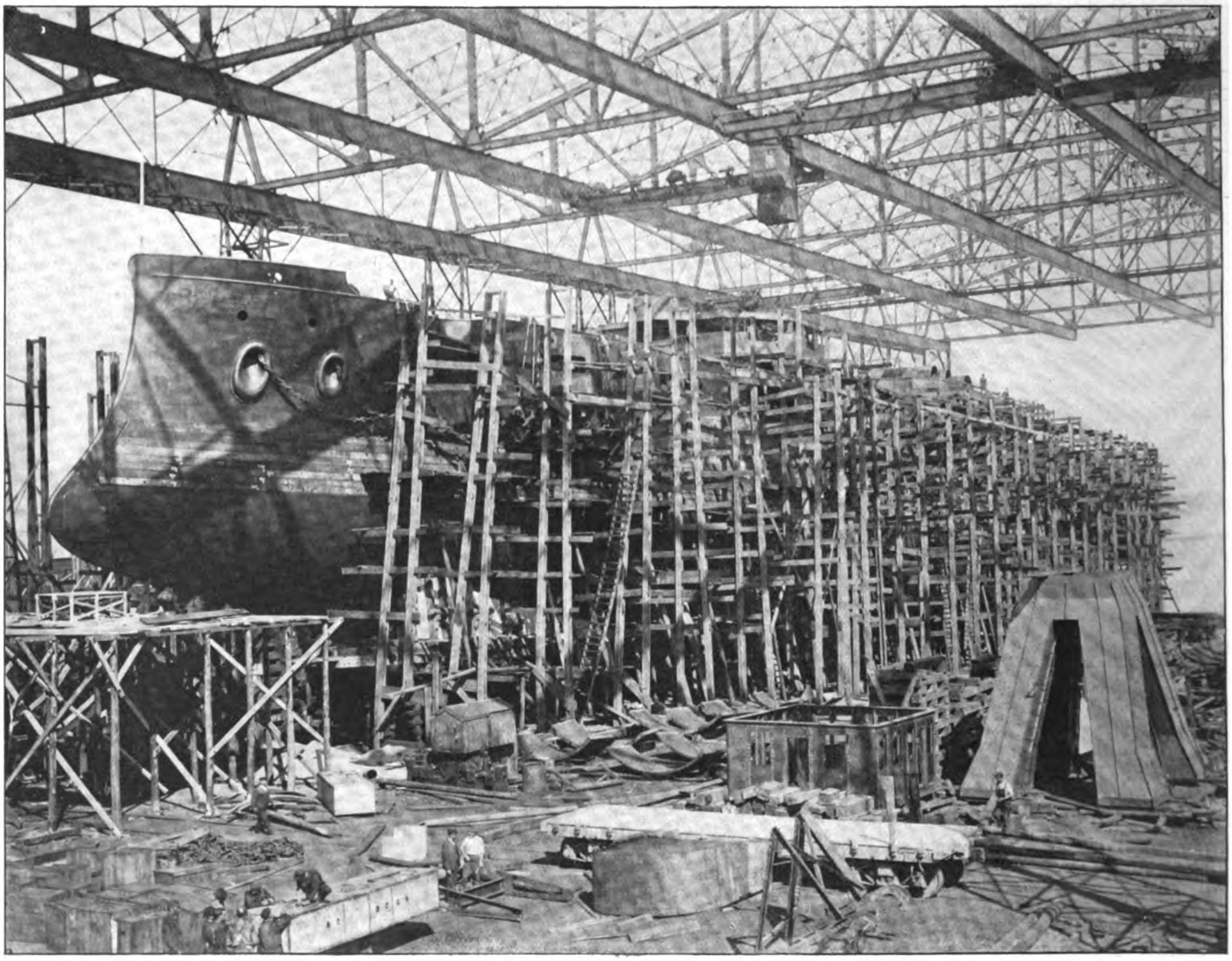
"But greatest of all, he is an envoy of peace. In uniting Russia, our long time friend, and Japan, our foster child, he has added great glory to himself."

The following description of the designs of the Vermont, one of the largest and most powerful battleships yet laid down for the navy, is taken from the official circular published for the information of bidders.

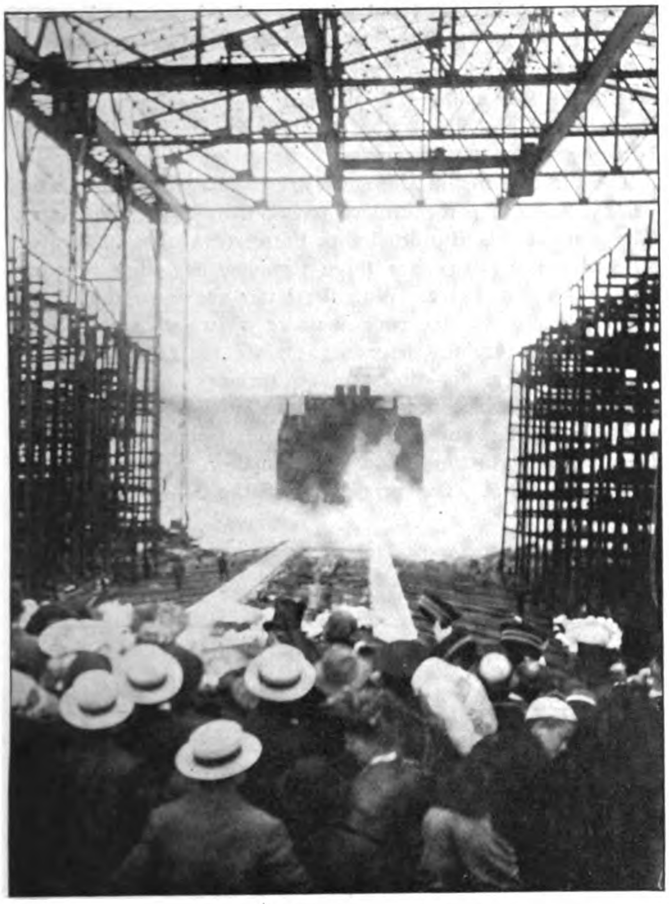
General dimensions and features of the vessel are as follows: Length of load water line, 450 ft.; breadth, extreme, at load water line, 76 10-12 ft.; displacement on trial, not more than, 16,000 tons; mean draft to bottom of keel at trial displacement, 24½ ft.; cross draft, full load about 26¾ ft.; total bunker capacity, coal, about, 2,000 tons; coal carried on trial, 900 tons; feed water carried on trial, 66 tons; trial speed at sea for four hours, 18 knots.

The hull is to be of steel throughout, and will be fitted with docking and bilge keels.

Armament.—Main battery: Four 12-in. breech-loading rifles; eight 8-in. breech-loading rifles; twelve 7-in. breech-loading rifles. Secondary battery: Twenty 3-in., 14-pounder, rapid-fire guns; twelve 3-pounder and semi-automatic guns; six 1-pounder automatic guns; two 1-pounder semi-automatic



BATTLESHIP VERMONT ON THE STOCKS AT FORE RIVER.



LAUNCH OF THE VERMONT.

guns; two 3-in. field pieces; two machine guns, caliber .30; six automatic guns, caliber .30.

The battery will be mounted as follows: The 12-in. guns in pairs in two electrically controlled, balanced, elliptical turrets on the center line, one forward and one aft, each with an arc of fire of about 270 degrees. The 8-in. guns in pairs in four electrically controlled, balanced, elliptical turrets, two on each beam, at each end of the superstructure. The 7-in. guns in broadside on pedestal mounts on the gun deck behind 7-in. armor, each gun being isolated by splinter bulkheads of nickel steel of from 1½ to 2 in. thick; forward and after guns arranged to fire right ahead and right astern respectively; other 7-in. guns to have the usual broadside train.

The guns of the secondary battery in commanding position, having a large arc of unobstructed fire, and protected wherever practicable.

All the 7-in. guns are so arranged that their muzzles train inside the line of the side armor, thus leaving a clear and unobstructed side when it is desired to go alongside a pier or vessel.

Arrangements will be made whereby the 3-in. guns on the main deck can be quickly and conveniently dismounted, housed, and secured.

Armor and Similar Protection.—The hull is protected at the water line by a complete belt of armor 9 ft. 3 in. wide, having a maximum thickness of 11 in. for about 200 ft. amidship. Forward and aft of this the maximum thickness is gradually decreased to 4 in. at the stem and stern. The lower casemate armor extends to the limits of the magazine spaces and reaches from the top of the water-line belt to the lower edge of the 7-in. gun ports on the main deck, and is 6 in. in thickness, the athwartship bulkheads at the ends of this casemate also being 6 in. thick.

The casemate armor around the 7-in. guns on the gun deck is 7 in. thick, and the splinter bulkheads are from 1½ to 2 in. thick. The protection of 3 in. guns is nickel steel 2 in. thick. The upper casemate athwartship armor extending from the shell plating to the 12-in. barbettes is to be 7 in. thick throughout.

The 12-in. barbettes extend from the protective deck to about 4 ft. above the main deck, and consist of 10 in. of armor in front and 7½ in. in the rear above the gun deck. Between the gun deck and protective deck there will be a uniform thickness of 6 in. The barbettes will not have any special framing, the connection of the armor to the decks being sufficient.

The 12-in. turrets will have a front plate 12 in. thick, rear plates 8 in. thick, and top plates 2½ in. thick.

The 8-in. barbettes will be 6 in. thick in front and 4 in. thick in rear, with the upper tube 3¾ in. thick and the lower tube 3 in. thick.

The 8-in. turret front plate will be 6½ in. thick, the rear plate 6 in. thick, and the top plates 2 in thick.

The conning tower and shield will each be 9 in., and the signal tower 6 in. thick. An armor tube 36 in. in diameter will extend from the base of the conning tower to the protective deck, and will be 6 in. thick throughout.

Teak backing of a minimum thickness of 3 in. will be fitted behind all side, athwartship, and 12-in. armor; 2 in. of backing to be fitted behind the 8-in. turret armor; other armor will be fitted without backing.

Protective Deck.—There is a complete protective deck extending from stem to stern, the deck being flat amidships, but sloped at the sides throughout, and sloped at each end. It will be built up of 20-lb. plating throughout, with nickel steel of 40 lbs. on the flat and of 100 lbs on the slopes.

The following nickel steel protection is also to be fitted:

Hatch covers and gratings in the protective deck; splinter bulkheads on gun deck; sponsons and wing plates for two forward 3-in. guns on gun deck; bullet shields between wing plates for 3-in. guns and 7-in. guns; side protection and wing plates for 3-in. guns on main deck; turret shelf plates; conning tower base plates; 7-in. gun port sill plates; 80-lb. protection on ammunition hoist trunks not otherwise protected by armor, and 80 lbs. protection on coaling trunks on slope of protective deck to the height of berth deck amidships.

Cofferdams about 30 in. thick and extending from protective deck level will be worked from end to end of the vessel, these cofferdams being extended above the berth deck, forward and abaft the transverse armor, to a height of about 36 inches.

The cofferdams will be packed with cellulose or other approved water excluding mineral.

Ammunition.—The magazines and shell rooms are so arranged that about one-half the total supply of ammunition will be carried at each end of the ship. Magazine bulkheads adjacent to heated compartments, such as firerooms, engine rooms, and dynamo rooms, are arranged with air spaces.

The ammunition for 7-in. and smaller guns will be conveyed by hoists directly from the ammunition rooms or ammunition passages to the deck on which it is required, or as near that as possible. These hoists will be driven at constant speed by an electric motor and will be arranged to deliver seven pieces per hoist per minute.

The number of hoists will be as follows: Twelve for 7-in., fourteen for 3-in., 3-pounder and 1-pounder combined, and sufficient whip hoists to the tops. To supply the 7-in. hoists, four horizontal ammunition conveyers, operated by electric motors, will be fitted in ammunition passages for the transfer of ammunition from the handling rooms to the base of the hoists.

The turret guns have regular turret ammunition hoists, op-

CONTINUED ON PAGE 32.

COMPARISON OF TURBINES AND RECIPROCATING ENGINES IN STEAMERS*

By William Gray.

In January, 1903, the Midland Railway Co. decided to build four new screw steamers for their Irish and Isle of Man services, in view of the approaching completion of their new harbor at Heysham, in Morecambe bay, Lancashire.

After careful consideration of the data available, the Midland Railway Co. decided to fit two of the vessels of their new fleet with reciprocating engines and two with Parsons marine turbines. Three of the vessels, the Antrim, Donegal, and Londonderry, were intended for the Belfast passenger and cargo trade, and the Manxman for the Isle of Man summer passenger traffic, although she was also fitted with portable cabins for taking up the Belfast trade in winter. The principal dimensions of the three former vessels are as follows: Length on the water line, 330 ft.; moulded breadth, 42 ft.; moulded depth, 25 ft. 6 in. The Manxman is similar in form, and of the same length and depth, but the moulded breadth is 43 ft.

The boiler installation in all the vessels consists of two double-ended and one single-ended boiler, the principal dimensions of which are given in parallel columns:

	Double-ended.	Single-ended.
Number	2	1
Length	22 ft.	11 ft. 6 in.
Diameter	15 ft. 7 in.	
Number of furnaces (total)	12	3
Heating surface in each ship	12,500 sq. ft.	
Grate area	400 sq. ft.	

The working pressure in the Antrim, Donegal and Manxman is 200 lbs. per square inch, and in the Londonderry 150 lbs. per square inch. Forced draught on the closed stokehold system is fitted in all the vessels. The fans for this purpose are driven by electric motors in the Antrim and Donegal and in the Londonderry and Manxman they are driven by steam engines.

The engines of the Antrim and Donegal consist of two sets of the four-cylinder, triple-expansion type, each driving a three-bladed propeller. The cylinders are 23 in., 36 in., and two of 42 in., by 30 in. stroke.

The turbines in the Manxman are the larger, as they were designed for 25 percent more power than the Londonderry. The Manxman is also fitted with Parsons' vacuum augmenter. In each vessel there are three turbines, one high pressure and two low pressure. With the latter are incorporated the reversing turbines that work *in vacuo* when not in use. Each of the three turbines drives a separate shaft, and a three-bladed propeller. The low-pressure turbines are on the outer shafts, and the high-pressure turbines on the center shaft.

The propellers of the Antrim and Donegal are three-bladed. The Antrim's is a little smaller in diameter and coarser in pitch. The propellers of the Manxman are as follows: Center, 6 ft. 2 in. diameter, 5 ft. 7 in. pitch; side, 5 ft. 7 in. diameter, 5 ft. pitch. The Londonderry's are all the same, 5 ft. diameter, 4 ft. 6 in. pitch.

The conditions of the contract were that each vessel was to maintain a speed of twenty knots per hour for six continuous hours with the double-ended boilers only under steam and 300 tons deadweight on board.

The results of the official trials were as follows:

	Antrim.	Londonderry.	Manxman.
Speed in knots	20.6	21.6	22.65

With all the boilers in use the results were:

	Antrim.	Londonderry.	Manxman.
Speed in knots	21.86	22.36	23.12

The amount of water consumed was measured during the progressive trials by counting the strokes of the feed pumps, and the comparative results are given in Table I:

TABLE II.

		T.S.S. "Antrim." (Reciprocating Engines.)			T.S.S. "Donegal." (Reciprocating Engines.)			"Londonderry." (Turbines.)			"Manxman." (Turbines.)		
Dates	No. of Passages	Tons of Coal Consumed	Hours under Steam	Hours Full Speed	Tons of Coal Consumed	Hours under Steam	Hours Full Speed	Tons of Coal Consumed	Hours under Steam	Hours Full Speed	Tons of Coal Consumed	Hours under Steam	Hours Full Speed
1904													
Sept. 1-10	9	282 0	67 3	55 1	......	......	......	284 8	65 3	54 9	......	......	......
Sept. 23-28	5	159 5	36 3	28 1	......	......	......	161.0	34.3	30.5	......	......	......
Sept. 29-Oct. 17	16	......	......	......	498.4	116.5	103 3	527 4	111 0	97 5	......	......	......
Oct. 18-Nov. 1	13	447.5	89 0	71.0	......	......	......	429.3	92 2	75 0	......	......	......
Dec. 1-15	13	......	......	......	465 0	91 3	78.5			......	507 7	84.1	74.1
Dec. 16-21	5	204 7	34 0	32 1	......	......	......	......	......	......	187.0	39.1	23.5
1905													
Dec. 29-Jan. 10	11	416.4	73 1	67.0	......	......	......	......	......	......	420.5	73 3	62 5
Jan. 25-Feb. 8	13	......	......	......	520 0	89.8	76 0	......	......	......	532 0	92 1	59 6
Feb. 9-23	13	499 7	89.0	72 1	......	......	......	......	......	......	512 0	83.8	73.5
Mar. 11-25	13	......	......	......	522 0	86.8	77 2	......		......	530 0	86 2	70.7
Mar. 31-Apr. 10	9	345.6	58.0	52.5	......	......	......	350 5	62 5	52.2	......	......	......
Apr. 26-May 10	13	......	......	......	551 0	89 2	78 4	512.0	84 0	72.4	......	......	......
May 12-25	12	472.8	74.5	68 2	......	......	......	470 3	77 4	67 5	......	......	......
June 10-24	13	......	......	......	459 1	87 1	78 5	510.5	82.9	72.9	......	......	......
	158	2828.2	521 2	446 1	3015.5	560.7	491.9	3245.8	609.6	522.9	2689.2	458.6	363 9

SUMMARY.

	"Antrim"	"Donegal"	"Londonderry"	"Manxman"
Number of passages	77	81	90	68
Coal per passage (tons)	36 7	37 2	36.1	39.6
Hours at full speed per passage	5 78	6.07	5 81	5.35
Hours at full speed, percentage of	85 5	87.7	85.7	79.5

*Abstract of a paper read at the summer meeting of the British Institution of Naval Architects, July 20, 1905.

TABLE I.—GALLONS OF WATER CONSUMED PER HOUR.

Speed in Knots.	Antrim and Donegal.	Londonderry.	Manxman.
14	4,500	4,500	4,500
17	6,700	6,100	5,800
20	9,700	8,900	8,300
22	....	13,600	12,500
23	....	....	17,300

These figures throw some light on the relative economy not only of the two systems of propulsion at various speeds, but on the different arrangements in the two turbine steamers themselves. They show that from 14 knots to 20 knots the turbine is more economical. The maximum difference occurs between 19 knots and 20 knots, which is the working speed of the vessels on service. In the case of the Londonderry the decrease in water consumption amounted to 8 percent, and in the case of the Manxman to 14 percent, as compared with the Antrim and Donegal.

Through the courtesy of the officials of the Midland Railway Co., the log books of the four steamers have been placed at the writer's disposal, and it is therefore possible to make some comparisons that may be of interest to those connected with ships. As the question under consideration is reciprocating engines versus turbines, those occasions when the Antrim and Donegal were running together have been omitted. The Londonderry and the Manxman have never been running together on this service.

Table II gives the following particulars for the various steamers, viz: (1) The number of single trips made from Belfast to Heysham, and vice versa. (2) The number of tons of coal consumed while under steam. (3) The total number of hours under steam. (4) The total number of hours at full speed.

The amount of coal consumed in port varies according to circumstances, and as it does not materially affect the matter under discussion, it has been excluded from these tables. It amounts approximately to about eight tons per steamer per single trip. The column "hours under steam" is the time from quay to quay, and includes the time occupied in maneuvering the vessel in harbor.

The table treats the matter from a purely commercial standpoint, that is to say, it ignores the differences of speed and coal consumption due to the relative weights of turbines and reciprocating engines, and only deals wth the items that exclusively interest shipowner. It gives the amount of coal that each vessel consumed on a given number of trips. In all four steamers the three boilers have been in use, and all have been working with the same moderate air pressure in the stokeholds. The results, therefore, represent the amount of coal consumed under easy steaming in all circumstances. To show the results obtained from each pair of steamers running simultaneously but in opposite directions, the previous table has been split up, as shown in Table III.

The speeds obtained on the trial trips have been already dealt with, but, valuable as these results are, the conditions in which trial trips are conducted are more or less artificial, and shipowners are justified in not taking them as final guides on the subject.

The logs have been very carefully examined, and, neglecting those runs where full speed was not maintained for the whole time that the vessels were in the open sea, the results are as follows:

TABLE III.—SHOWING RESULTS OBTAINED BY STEAMERS RUNNING SIMULTANEOUSLY, BUT IN OPPOSITE DIRECTIONS.

	Reciprocating Engine.	Turbines.
	"Antrim."	"Londonderry."
Number of trips..............	48	48
Average coal per trip (tons)...	35.6	35.3
Average speed in knots........	19.7	19.5
	"Donegal."	"Londonderry."
Number of trips..............	42	42
Average coal per trip (tons)...	36.0	36.9
Average speed in knots........	19.2	19.8
	"Antrim."	"Manxman."
Number of trips..............	20	29
Average coal per trip (tons)...	38.6	38.6
Average speed in knots........	19.05	20.3
	"Donegal."	"Manxman."
Number of trips..............	39	39
Average coal per trip (tons)...	38.7	40.2
Average speed in knots........	19.3	20.3

These results point to a marked decrease in the coal consumption of the Manxman, as compared with the Atrim and Donegal. The Manxman did 20.3 knots for the same coal consumption that the Antrim had at 19.5 knots. A similar comparison of the Manxman with the Donegal gives nearly the same results. The performances of the Londonderry are nearly as efficient as those of the Antrim, but they are better than those of the Donegal. They also indicate that the Manxman with higher steam pressure, a smaller number of revolutions, and larger propellers, has done better than the Londonderry.

A further economy in the turbine steamers is effected in the amount of oil used for lubrication. The logs show that this amounts in both steamers to five gallons per single trip. This again permits of a further economy in the reduction of the engine room staff from four greasers to two. Speaking generally, therefore, the performances of the turbine steamers, especially the Manxman, have been greatly superior to those of the steamers fitted with reciprocating engines.

It is not possible to make a quantitative analysis of the cost of upkeep, but so far the turbines have cost practically nothing, and they require very little attention compared with what is necessary in the very best-running engines of the reciprocating type.

There can be no doubt that one great benefit derived from the use of turbines is the elimination of the vibration inseparable from the use of reciprocating engines in channel steamers. The engines in the Antrim and Donegal were most carefully balanced, and the vibration at the service speed is almost imperceptible. The almost unanimous testimony, however, of those who have traveled in the vessel is, that the turbine steamers are steadier.

The only real inferiority in the Londonderry and Manxman is the difficulty of maneuvering from rest in narrow waters. In this respect they compare unfavorably with the Antrim and Donegal. Experiments were made at the trial trips that showed the turbine steamers going full speed could be brought to rest in about one and a half minutes. This is a good result, but actual experience has shown the relative inadequacy of the backing power starting from rest. There is no good reason why sufficient backing power cannot be obtained with small screws if the reversing turbines are made powerful enough.

Having dealt with the question of speed and coal consumption there remain three other points in connection with the design, viz.: Space occupied, weight, and cost. The turbines occupied so much more floor space than the reciprocating engines that the electric plant had to be put in the tunnel. Space may be saved on the upper decks, but this is not an unmixed advantage, as it was effected by reducing the light and air space to the turbine room. The effect of decreasing the light and air space to the turbine room involved an increase in the net tonnage of nearly fifty tons.

In the case of vessels trading between ports where tonnage dues are heavy, this is a matter of great importance, and may

balance the economical gains in oil and fuel. In such cases the gain in space cannot be used with advantage.

The saving of weight in the turbine steamers is considerable. In the hull the weights involved, viz., engine seat, tunnel stools, boss frames, and plating, etc., are reduced by 30 tons. Against this the buoyancy of the bosses is 29 tons less in the turbine than in the other steamers, so that from the draught point of view the saving in hull is neutralized by the loss of displacement. The weight of engines, shafting, and propellers in the Antrim and Donegal was 280 tons. The weight of the corresponding items in the Manxman was 195 tons, so that the total weight to be propelled is about 115 tons less, a difference of nearly 6 percent on the light weight of the steamer.

The difference of the initial cost of the turbines as compared with engines is not great. Comparing the Antrim and the Londonderry it amounted to one and a half percent of the total cost of hull and machinery. In other words, for a speed of 19.5 knots the Antrim requires 38.6 tons of coal and the Manxman 35.0 tons, a saving of 9.3 percent. The Donegal for a speed of 19.3 knots requires 38.7 tons and the Manxman 35.4 tons, a saving of 8.5 percent.

Launch of Battleship Vermont

CONTINUED FROM PAGE 29.

erated by electric power, these hoists leading directly from the handling rooms or the ammunition passages to the turrets. For transporting 12-in., 8-in. and 7-in. ammunition, trolleys and tracks will be fitted in handling rooms, passages and shell rooms.

Propelling Machinery.—The engines will be of the vertical, twin screw, four-clinder, triple expansion type, of a combined I. H. P. of 16,500. The steam pressure will be 250 lb. The stroke will be 4 ft. The ratio of high pressure to low pressure cylinder will be at least 1 to 7, and the diameters will be sufficient for the required I. H. P. at about 120 revolutions per minute. Each engine will be located in a separate watertight compartment. There will be twelve boilers of the Babcock & Wilcox type, placed in six watertight compartments. They will have at least 1,100 sq. ft. of grate and 46,750 sq. ft. of heating surface, and must be able to furnish steam for the main engines and all necessary auxiliary machinery and other steam machinery throughout the ship with an average air pressure in the ash pits of not more than 1 in. of water. There will be three funnels, each 100 ft. high above the base line.

The following auxiliary steam machinery of approved make and design, in addition to that pertaining to the main engines and dependencies, is to be supplied: steering engine; windlass engine; ash hoist engine for each fire room; forced draft blowers; ice plant with a cooling effect of three tons of ice per twenty-four hours; evaporating plant to consist of not less than four units, having a total capacity of 16,500 gallons of fresh water per day; a distilling apparatus capable of condensing at least 10,000 gallons of water per day. The vessel to be heated by steam throughout.

The weight of all machinery and tools, stores, and spare parts will be about 1,500 tons.

The vessel will be lighted throughout by electricity. The electric plant will consist of eight 100-kilowatt steam driven generating sets, all to be of 125 volts pressure at the terminals, disposed in two separate and independent dynamo rooms.

There will be fitted all the usual means of interior communication, such as telephones, voice pipes, call bells, buzzers, gongs and annunciators, engine and steering telegraphs, revolution and rudder indicators, heeling indicators, automatic fire alarm, warning signals, alarm signals, etc. The total weight of equipment outfit, complete, will not exceed 355.28 tons.

With the exception of the auxiliaries above mentioned to be operated by steam, all power on board of the vessel will be electric, as, for instance, boat cranes, deck winches, turret turning motors, ventilation blower motors, etc.

All main compartments of the ship below the gun deck, except the coal bunkers, are to be provided with forced ventilation, there being no less than thirty-three blowers, with a combined capacity of not less than 104,000 cu. ft. per minute. Special attention has been given to spaces subject to habitually high temperature, such as engine rooms, fire rooms, and dynamo rooms. The ventilation system will be designed to cut the minimum number of watertight bulkheads. All blowers, except forced draft blowers, are to be electrically operated.

The coal bunkers are to be arranged with satisfactory reference to the rapid and efficient supply of coal to the fire rooms and have a maximum capacity of about 2,200 tons. There are to be provided for coaling not less than six winches, twelve booms, and all necessary fixed chutes, scuttles, hatches and other openings. There will be two bill boards and four hawse pipes, each hawse pipe to be so designed that stockless anchors may be stowed in them. There will be four heavy anchors, two of the navy type and two of the stockless type.

The following boats will be carried, adequate provision being made for their convenient stowage and handling, two electrically operated boat cranes, eight pairs of boat davits, adjustable boat chocks, and all necessary fittings being provided for this purpose: One 50-ft. steam cutter, two 36-ft. steam cutters, one 36-ft. steam launch, three 33-ft. launches, five 30-ft. cutters, two 30-ft. whaleboats, one 30-ft. gig whaleboat, one 30-ft. barge, two 20-ft. dingeys, one 16-ft dingey, one 14-ft. dingey, and two life rafts.

The vessel is designed as a flagship, and the arrangement of quarters providing ample accommodations for the following complements: A flag officer, a chief of staff, nineteen wardroom officers, ten junior officers, ten warrant officers, and not less than 761 men, including 60 marines.

There is a lower bridge both forward and aft, and a flying bridge forward, according to the latest practice. On the flying bridge is fitted a screen of bronze for the protection of the men at the wheel, and there is also a bronze chart house forward.

There are steel masts forward and aft, the foremast having an upper and lower top, the main mast a lower top only. Masts are arranged for wireless telegraphy. There is one signal yard on each mast, also a searchlight platform forward and aft, with a crow's nest on the foremast.

A summary of the weights to be carried on trial is as follows:

	Tons.
Guns, mounts, magazine equipments, etc	944.94
Ammunition, two-thirds full supply	393.97
Steam engineering complete, with water in boilers, condensers, piping, etc., and stores, etc., not to exceed	1500.
Reserve fresh water for steaming purposes	66.
Coal, normal supply	900.
Boats and outfits	51.27
Masts and spars	30.98
Equipment complete, including anchors, chains, electric plant, etc., and two-thirds equipment stores	355.28
Miscellaneous stores and water, two-thirds full supply	81.32
Provisions, clothing and small stores, two-thirds full supply	146.84
Officers, crew and effects	103.32
Total protection, including armor, armor backing, armor bolts, cellulose, and splinter bulkheads	3992.

DISASTROUS STORM ON LAKE SUPERIOR

The storm which broke out in the vicinity of the Apostle Islands, Lake Superior, during the latter part of last week was one of the most disastrous in lake history. It is not usual for a storm to affect the modern freighter with its great strength and great displacement but this greatly crippled a number and made several seek shelter. It completely wrecked the steel steamer Sevona, owned by James McBrier, of Erie. The Sevona was bound down from Allouez to Erie with ore. She ran into the teeth of a northwester on Friday last. Capt. D. S. McDonald tried to make headway against the heavy sea but turned and ran for shelter when the storm became too violent. The location in which he found himself is one of the most dangerous in Lake Superior. Sand Island is in the center of a cluster of dangerous reefs. One and a half miles east of the light on the island is the Sand Island reef. The storm was so severe that the lookout did not see the Raspberry Island light. When the Sand Island lighthouse was sighted it was too late. Capt. McDonald tried to put about but the storm swept him irresistibly on the reefs. Within half an hour after striking, the fury of the waters had hammered the Sevona in half. The vessel broke in two just aft of the fourth hatch. Life boats were launched and the crew under command of Engineer Phillippi endeavored to take the women passengers ashore. They succeeded in doing so after a night of terror. Capt. McDonald, the two mates and four sailors remained on the broken forward half of the vessel in the hope of rescue but they were drowned. The Sevona was built by F. W. Wheeler at West Bay City in 1890, for Hollister Bros., of Buffalo, and when she came out was known as the Emily P. Weed. She was lengthened 72 ft. last year at the Buffalo yard of the American Ship Building Co., and was insured for $160,000.

The steamer Iosco, owned by W. A. Hawgood & Co., of Cleveland, and its tow, the Olive Jeanette, also foundered in the gale. The first known of this catastrophe was conveyed by wreckage through which the tug D. L. Hebard passed near Huron Island. The lighthouse keeper on Huron Island saw a big schooner founder four miles north of the light but was unable to determine her name. He saw no steamer at the time, but the Hawgoods gave up hope on Wednesday that the Iosco could possibly be afloat. The Iosco carried a crew of nineteen men and the Olive Jeanette of seven.

The Iosco was a wooden steamer and was built by F. W. Wheeler & Co., West Bay City, in 1891. She was 291 ft. long, 41 ft. beam and 20 ft. deep. The Olive Jeanette was also built at Bay City by Wheeler & Co., and came out in 1890. She was 242 ft. long and 39 ft. beam. The Iosco was insured for $65,000 in companies represented by Smith, Davis & Co., of Buffalo. The Jeanette was insured for $40,000. The Iosco and her tow left Duluth at noon on Thursday last with ore shipped by M. A. Hanna & Co., of Cleveland.

The schooner Pretoria also foundered in the gale. She was owned by James Davidson, of Bay City, and is the first vessel that Capt. Davidson has lost through storms. She was built in 1900 and was 338 ft. long, 44 ft. beam and 25 ft. deep. She was valued at about $75,000, but no insurance was carried on her. Four lives were lost on her.

The storm caused the great steel steamer D. M. Clemson to put back into Two Harbors with a list of 4 ft. When the storm broke the steamer was boarded by heavy seas and two hatches were broken open. It was then determined to seek shelter.

Vessel masters agree that the storm was the worst that they had experienced in twenty-five years. Frank Smith, the second engineer of the steamer R. L. Ireland, was washed overboard about sixty miles east of Kewaunee Point and was lost. John Linquist, a seaman, was washed overboard from the steamer Samuel Mather off Knife Island and was lost.

The new steamer Powell Stackhouse, just out of the shipyard, went through the storm all right, but Capt. Millen reported that the patent hatches would spring and allow water to enter the hold. She was drawing 20 ft. 5 in. when she reached Sault Ste. Marie and had to lighter her cargo in the rivers to cross the Lime Kilns.

It is impossible to determine at this moment just how many lives were lost in this great storm, but the number is between thirty and forty.

CHICAGO GRAIN REPORT

Chicago, Sept. 5.—Total shipments of the past week were upward of 4,000,000 bu. with flour movement of 166,700 bbls., but reflecting the continued steady call of vessel room rates ruled unchanged at basis 1⅛ cents and 1¼ cents Buffalo corn, according to quantity and location, and at basis 4 cents through to Montreal. Deliveries on September contracts are well up to expectations and likely to occasion some fair chartering activity, but it will require the movement of Northwest grain in order to vest this quarter with any substantially improved tone.

Shipments of the week are distributed as follows: Via all rail lines of flour, 70,770 bbls.; wheat, 128,735 bu.; corn, 180,523 bu., and oats, 867,519 bu. To Buffalo and other American points, of flour, 90,949 bbls.; wheat, 97,000 bu.; corn, 2,178,681 bu., and oats, 118,000 bu. And via lake to Canada, of flour, 5,058 bbls.; wheat, 52,000 bu.; corn, 417,300 bu, and oats, 194,000 bu.

Lake and Rail shipments:

	This week.	Last week.	Same week last year.
Wheat	291,156	459,276	323,514
Corn	2,776,515	2,580,757	2,172,806
Oats	1,180,390	1,545,140	912,050
Rye	66,937	3,363	14,221
Barley	34,291	126,127	29,907
	4,349,289	4,714,663	3,452,489
Flour	166,777 (bbls.)	197,329	100,032

	Since Jan. 1, 1905.	Same time last year.
Wheat	9,265,860	9,720,110
Corn	65,017,156	46,199,440
Oats	36,465,710	31,750,960
Rye	697,893	858,468
Barley	2,652,727	2,864,236
	114,099,346	91,393,214
Flour	4,032,873 (bbls.)	5,164,674

Stocks in Public and Private Elevators:

	This week.	Last week.	Same week last year.
Wheat	5,493,000	5,586,000	3,691,000
Corn	3,444,000	3,548,000	3,773,000
Oats	8,095,000	7,350,000	7,304,000
Rye	142,000	156,000	642,000
Barley	53,714	52,714	96,000
	17,227,714	16,692,714	15,506,000

The steamer Columbia, of the Detroit River Ferry Co., which is one of the largest and best excursion boats on the lakes, will come to Cleveland this month. She will be here Sept. 13 and 19 and will give two lake rides each day. Her passenger capacity is 3,566, and nearly 1,000 persons can dance at one time on the boat. Mr. Walter E. Campbell, of Detroit, is manager of the big boat.

ACCEPTANCE TRIAL OF THE PENNSYLVANIA

The recent performance of the Cramp-built armored cruiser Pennsylvania during her final acceptance trial is worthy of careful study. The Pennsylvania is one of six cruisers, built or building at the Union Iron Works, Newport News Co. and Cramps, two at each yard. They are all sisters, identical in type and specifications. The final acceptance trial was conducted with the navy department's crew of engineers and firemen, and the Pennsylvania is the only vessel of the American navy which has accomplished a trial of four hours with forced draft with the regular crew wherein the contract speed has been exceeded. Prior to the Colorado and Pennsylvania it was the custom of the navy department to conduct the final acceptance trials so that the boilers were run under maximum natural draft conditions for a set period. On these two cruisers a full forced draft four hours' trial was added and the success achieved was so marked that in the future such forced draft trials are apt to be required for all vessels. Such a policy would do much towards inspiring the entire service with the capabilities of the fleet. It also tests the drill and efficiency of the engineering force and refutes the old idea that naval vessels could never attain the speed that the contractors could under more advantageous conditions. The trial was conducted by the Board of Inspection and Survey, Capt. James H. Dayton, president; Capt. H. C. Leutz, Capt. Joseph J. Woodward, Com'dr Isaac S. Reeves and Com'dr Templin M. Potts, recorder.

The contract for the six vessels of the Pennsylvania class called for the development of a speed of 22 knots an hour with an indicated horse power of 23,000. Under the former policy of the Bureau of Construction and Engineering certain latitude was allowed the builders in modification of design in order to enlist their heartiest cooperation. In the case of the Pennsylvania the results obtained are directly attributable to certain modifications in the boiler room and engine room which resulted greatly in improving the speed and efficiency of the ship. The changes allowed by the government were the installation of a battery of thirty-two modified Niclausse boilers, the modifications being in the direction of larger tubes and drum and general simplification of details. The main steam pipe was increased from 13 in. to 15 in. diameter, because it was considered that for a piston speed of nearly 1,100 ft. a minute a pipe of the larger diameter would be a necessity. The boilers were built for 300 lbs. and the arrangement of the cylinders was modified so as to give a more direct flow to the steam; the order in the department design being low pressure, high pressure, intermediate and low pressure, which is changed in the Cramp design to high pressure, intermediate, low pressure and low pressure. Another radical change was that instead of the low pressure cylinders being assisted by introducing live steam from the boilers, this connection was dispensed with and instead the exhaust from the auxiliary was fed direct to the low pressure cylinders. It will thus be seen that the changes were thoroughly in touch with the latest marine practice involving high boiler pressure, ample steam pipe connections to convey an abundance of steam to the cylinders and a literal adherence to the principles of triple compound expansion by using live steam only in the high-pressure cylinders and allowing it to develop its full expansive efficiency from throttle to condenser. A comparison of the trials of a sistership built at another yard becomes interesting. On her contractors' trial trip the average speed of this ship was 22.12 knots, with 25,750 H. P. on a coal consumption of 3.2 lbs. per indicated horse power per hour. The Pennsylvania on her contractors' trial trip last year averaged 22.43 knots, with an average indication of 27,750 H. P. on an average coal consumption of 2.2 per horse power per hour, the temperature in the uptake in the first case being over 1,000 degrees and in the case of the Pennsylvania 650 degrees.

The Pennsylvania left Newport harbor about noon on Tuesday, July 25. At 2:40 p. m. her official forced draft trial lasting four hours was commenced under practically the same conditions as she maintained in the contractor's trial. The engine performance was highly creditable to the engine force of the ship, as the maximum indicated horse power of 30,150 was reached, the average for four hours being 29,843; average speed 22.08 knots.

Immediately after the completion of the four-hour forced draft test an eight-hour natural draft trial was commenced with all boilers in use. This lasted from 7 p. m. Tuesday until 3 a. m. Wednesday. The average results obtained were 19.8 speed and the average horse power 17,040. After the completion of the steam trials the batteries as installed were tested and showed that the ship was perfectly strong in every respect and fit for immediate active service.

The speed of 22.08 knots under forced draft was ascertained by plotting the number of revolutions 125.66 for four hours on the speed curve constructed from the results of standardizing trials made at Provincetown a few weeks before. The draught of water on the trial course does not exceed 25 fathoms, which certainly is not enough for a vessel of the size and draught of the Pennsylvania. Had she been tried on the English deep water courses she would have possibly increased her speed one to one and a half knots. As it was the patent log showed an average of 22.8 knots. The Pennsylvania has not been docked since November which makes the performance all the more remarkable. This trial also was a triumph for the Niclausse boilers. At all times during the four hours' run there was an abundance of steam and the safety valves were blowing off. The coal used was run of the mine Cumberland instead of Pocahontas as used by the contractors in the official trials. By reason of the magnificent condition of the vessel in all departments, too much praise cannot be given to the very efficient organization under command of Capt. T. C. McLean.

Data in detail of the forced draft and of the natural draft trials is herewith given.

	Starboard.		Port.
Numbers of hours forced draft..		4.	
Mean revolutions of engines....	124.95	......	126.37
Mean revolution of both engines		125.66	
Steam pressure in boilers.......		283.75	
Steam pressure in H. P. cylinder		256.	
Steam Pressure in 1st receiver absolute	122.75	......	125.
Steam pressure in 2nd receiver absolute	36.25	......	40.
Steam cut-off in H. P. cylinder..	.80	......	.80
Steam cut-off in L. P. cylinder..	.76	......	.77
Steam cut-off in L. P. cylinder..	.79	......	.78
Vacuum	24.375	......	24.
Temperatures, fireroom	102.5	......	102.5
" injection	73.	......	73.
" discharge	132.2	......	129.
" feed water	180.5	......	179.
Revolutions of air pumps per minute	11.	......	20.
Revolutions of circulating pumps per minute	115.	......	170.
Grate surface in use...........	1,600.	......	....
I. H. P. main engines.........	14,212.75	......	14,480.85
I. H. P. both engines..........		28,693.6	
I. H. P. auxiliaries...........	1,149.85	......	
Aggregate I. H. P.............		29,843.45	
Pounds of coal per hour......................			52,332.5
" " per sq. ft. of grate in use.......			32.707
" " per I. H. P. main engines......			1.82
" " per I. H. P. main engs. & auxs...			1.75

Mean draft at beginning of trial F. 22′ 10½″ A. 25′ 7″

Displacement.

Mean speed by patent log in knots per hour.......	22.8
Mean speed by speed curve in knots per hour.......	22.08
Slip of screw, percent............................	19.2
Average air pressure, in inches of water.	

FINAL ACCEPTANCE TRIAL OF PENNSYLVANIA.

	Sta board.		Po't.
Number of hours natural draft		8.	
Mean revolutions of engines....	108.18	......	108.66
" both engines.		108.42	
Steam pressure in boilers......		232.	
" H. P. cylinder		200.	
" 1st receiver absolute ..	79.7	......	75.
" 2nd receiver absolute ..	22.8	......	23.8
Steam cut-off in H. P. cylinder..	.80	......	.80
" I. P. cylinder...	.76	......	.77
" L. P. cylinder.	.79	......	.78
Vacuum	25.375	......	25.25
Temperatures, fireroom	115.8	......	115.8
" injection	73.	......	73.
" discharge	121.5	......	122.7
" feed water	170.6	......	170.6
Revolutions of air pumps per minute	12.8	......	17.3
" circulat'g pumps per minute...	123.	......	148.2
Grate surface in use...........	1,600.	......	148.2
I. H. P. main engines..........	8,271.55	......	8,129.7
I. H. P. both engines..........		16,401.25	
I. H. P. auxiliaries..............		640.7	
Aggregate I. H. P............		17,041.95	
Pounds of coal per hour........................			48,523.7
" per sq. ft. of grate in use........			30.32
" per I. H. P. main engines........			2.05
" per I. H. P. main engs. & auxs...			2.84
Mean draft at beginning of trial.			

Displacement.

Mean speed by patent log in knots per hour........	20.66
Mean speed by speed curve in knots per hour......	19.8
Slip of screw, percent.............................	.16
Average air pressure.	

BONAPARTE ARRAIGNS NAVAL OFFICERS

Secretary Bonaparte in his action upon the findings in the court of inquiry in the case of the Bennington explosion severely arraigns some officers of the vessel for failure to look after the safety valves; orders Com'dr Lucien Young before a court-martial to clear himself of the "charge of neglect of official duty"; directs the court-martial of Ensign Wade on the charge of "neglect of duty," and disapproves the court of inquiry's finding that the Bennington was "in an excellent state of discipline and in good and efficient condition."

Ensign Wade was in charge of the machinery. The action as to Com'dr Young was taken in view of the fact that the court of inquiry in its findings and opinion did not pass expressly upon his conduct and the question of his responsibility for the explosion. Referring to the findings of the court that the ship was in an excellent state of discipline and in a good and efficient condition, Secretary Bonaparte says:

"The department does not consider this particular finding sustained by the evidence; the proof tends strongly to show that the enlisted force of the engineering division had been permitted to fall into habits of laxity and inattention in the discharge of their duty, and at least some of this force were also imperfectly instructed regarding their duties. In the view of the department, the evidence establishes, further, that certain appurtenances, to wit, the safety and sentinel valves of at least one of the boilers, were not in an efficient condition at the date mentioned, and had not been in such condition for a considerable time previously, and, in the judgment of the department, this evidence renders the statements that the ship was in a 'good and efficient condition,' and that her boilers were in 'fair condition and efficient,' inappropriate to the facts disclosed by the proof."

The secretary then discusses certain portions of the evidence which, he says, were sufficient to justify the court in advancing another charge of neglect of duty against Ensign Wade and proceeds:

"The department approves the recommendation of the court of inquiry that Ensign Charles T. Wade, United States navy, be brought to trial by court-martial upon the charges contained in the opinion of said court of inquiry. Such court-martial is hereby ordered, but the judge advocate is instructed to include in the charges and specifications the further charge hereinbefore set forth.

"Inasmuch as the court of inquiry did not pass expressly in its findings and opinion upon the conduct of Com'dr Lucien Young, United States navy, commanding the United States ship Bennington, and the question of his responsibility, the department must treat this silence as an implied finding that he was not thus responsible. After very careful consideration the department is compelled to disapprove this implied finding.

"The provisions of the regulations, and the facts disclosed by the report of the court of inquiry, make it the duty of the department to require Com'dr Lucien Young to clear himself before a general court-martial of the charge of neglect of his official duty above indicated. Such court-martial is therefore ordered."

Secretary Bonaparte then praises "the highly creditable conduct of all the survivors of the officers and crew of the Bennington after the explosion occurred." He includes in this commendation Com'dr Lucien Young and Ensign Charles T. Wade and Lieut. A. F. H. Yates.

"Notwithstanding the severe loss sustained by the ship's complement," says the secretary, "discipline was fully maintained; all the officers seem to have discharged their duties with entire presence of mind, intelligence, and courage; the crippled vessel was handled judiciously and skilfully, and survivors of the crew showed bravery and humanity in the rescue of their unfortunate shipmates worthy of the honorable traditions of our service. The department notes with pleasure these redeeming features of an appalling and also discreditable disaster."

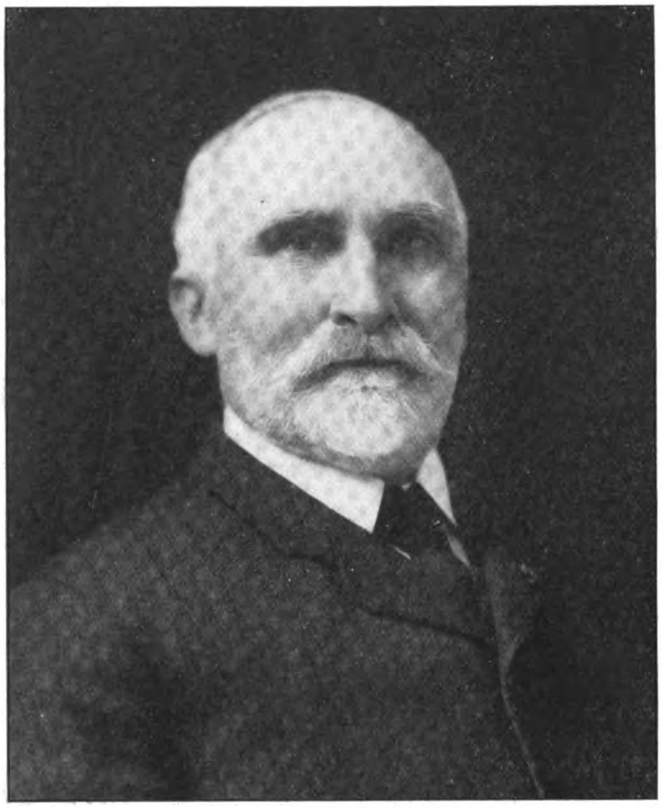
PENOBSCOT TO BE LENGTHENED NINETY-SIX FEET

The Lake Transit Co., of Buffalo, has closed a contract with the Craig Ship Building Co., of Toledo, for lengthening the steamer Penobscot 96 ft. during the coming winter. This plan of increasing carrying capacity became quite popular last winter when six lake vessels each received an additional 72 ft. amidship, increasing their capacity about 1,500 tons. That a contract for this work on the Penobscot should be let thus early may be taken as a fair indication that several others will be lengthened this winter as vessels enlarged have performed very satisfactorily and owners are pleased with the outcome. Owners as a rule do not consider this work until the end of the season, and it is definitely known where the boat will be after delivering her final cargo.

There are on the Pacific coast two completed naval drydocks, one at the Mare Island, Cal., navy yard, and the other at the Bremerton navy yard on Puget Sound. Active construction of a third dock began on Aug. 1 at Mare island. The Vallejo Chamber of Commerce has been reorganized and will urge the claims of the Mare island navy yard on the senators and representatives from California. The building of another stone drydock on the Pacific coast is to be recommended by the navy department.

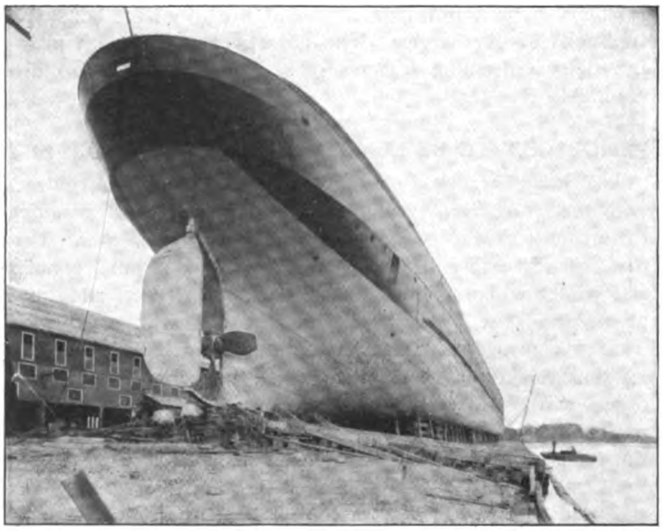
LAUNCH OF THE FRANK J. HECKER

The launch of the steamer Frank J. Hecker at the St. Clair yard of the Great Lakes Engineering Works on Saturday



COL. FRANK J. HECKER.

last was an event of more than usual importance, and was so characterized by the ceremony which marked it. The Hecker is the second vessel which the Great Lakes Engineer-

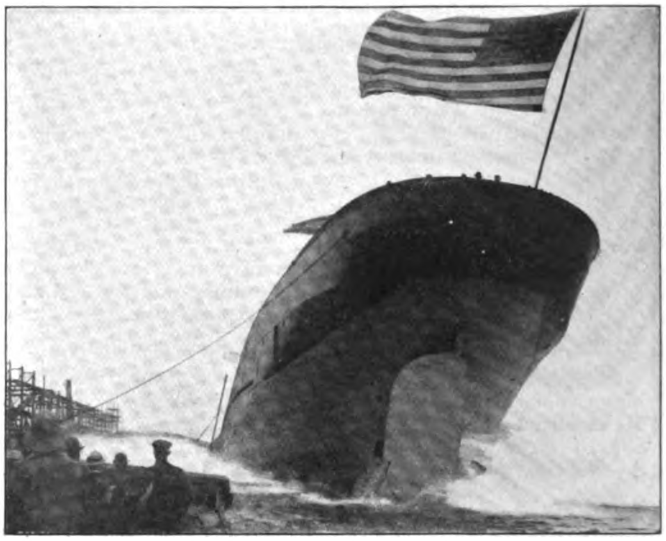


THE HECKER ON THE STOCKS.

ing Works has launched at St. Clair, but the first that it has launched since it became the actual owner of the yard. The company gave emphasis to its possession of this yard by an elaborate banquet at the Oakland Hotel immediately following the launch of the Hecker. It is the intention of the company to greatly enlarge its facilities at this plant and also to extend the area of the yard. At present there is provision for building only one steamer at a time, but it is intended eventually to make the yard capable of constructing three steamers at one time.

The Hecker was named by Mme. de Szilassy in honor of her father, Col. Frank J. Hecker. The launch was successful in every way, the Hecker taking the water on an even keel and without any hitch whatever. The steamer is building for the Gilchrist Transportation Co., of Cleveland, and is a sister ship of the George H. Russel, launched at this yard in April last. Both the Russel and Hecker are 484 ft. over all, 464 ft. keel, 50 ft. beam and 28 ft. deep, and are equipped with triple-expansion engines, 22, 36 and 60 in. cylinder diameters by 40 in. stroke, supplied with steam from two Scotch boilers, 13 ft. in diameter and 11 ft. 6 in. long. While both boats are classed as 7,500-ton boats, the Russel. which has been in commission for some time, has carried 8,200 tons.

The launching party went from Detroit to St. Clair in a special car and included Col. and Mrs. F. J. Hecker, Mme. de Szilassy, Antonio C. Pessano, president and general man-



LAUNCH OF THE HECKER.

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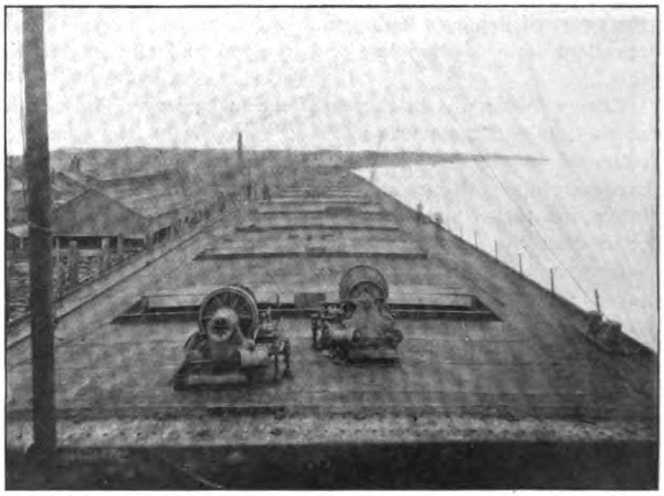
ager of the Great Lakes Engineering Works; Mr. John R. Russel, Henry Russel, S. R. Russel, Mr. and Mrs. J. C. Hutchins, Frank E. Kirby, Capt. A. E. Stewart, J. C. Mc-



DECK VIEW OF THE HECKER.

Donald, Miss Nora Johnson and Miss Hance, of Detroit; Mr. J. C. Gilchrist Mr. J. D. Gilchrist, Mr. W. B. Gilchrist,

Mr. and Mrs. F. D. Gilchrist, H. S. Snyder, Mr. and Mrs. Lee Selover, of Cleveland; Capt. Joseph Perew, J. S. Watterson, H. S. Sill, of Buffalo; Mr. and Mrs. B. S. Wood, Bellevue, O.; Mr. and Mrs. B. T. Knowlton, Cadillac, Mich., and Mr. G. F. Thompson, Youngstown, O. The party were joined at the banquet at the Oakland by Congressman Henry McMorran.

President Antonio C. Pessano acted as toastmaster at the banquet and responses to toasts were made by Col. Hecker, Henry Russel, Congressman McMorran, Mr. J. C. Hutchins and Mr. J. C. Gilchrist.

COMMERCE OF SAULT STE. MARIE CANAL

The commerce of the Sault Ste. Marie canal during August reached the figure of 6,327,595 net tons, as against 5,644,772 net tons for August of last year. The year 1905 is the only year in which the commerce of these canals has reached the six-million mark. The total movement of freight to Sept. 1 of the present year has been 26,164,799 tons, as against 14,842,975 tons to Sept. 1 of last year, and 22,628,170 tons to Sept. 1, 1903. The great increase has been in the iron ore movement and some of the other commodities show a decided falling off. Following is the summary of traffic brought up to Sept. 1 of the present year with comparative tables for the corresponding period during 1903 and 1904:

MOVEMENT OF PRINCIPAL ITEMS OF FREIGHT TO AND FROM LAKE SUPERIOR.

Items	To Sept. 1, 1905	To Sept. 1, 1904	To Sept. 1, 1903
Coal, anthracite, net tons	550,786	518,574	645,894
Coal, bituminous, net tons	3,427,034	2,355,166	3,976,210
Iron ore, net tons	19,596,553	8,696,180	14,980,989
Wheat, bushels	16,086,194	18,617,797	27,248,29'
Flour, barrels	2,126,092	1,645,403	3,821,120

REPORT OF FREIGHT AND PASSENGER TRAFFIC TO AND FROM LAKE SUPERIOR, FROM OPENING OF NAVIGATION TO SEPT. 1 OF EACH YEAR FOR THREE YEARS PAST.

EAST BOUND.

Items.	To Sept. 1, 1905.	To Sept. 1, 1904.	To Sept. 1, 1903.
Copper, net tons	56,580	48,847	59,269
Grain, other than wheat, bushels	12,705,843	8,744,364	11,726,457
Building stone, net tons	7,463	14,234	8,440
Flour, barrels	2,118,917	1,645,296	3,821,090
Iron ore, net tons	19,596,553	8,696,180	14,980,989
Iron, pig, net tons	39,724	21,190	8,963
Lumber, M. ft. B. M.	570,119	493,324	576,118
Silver ore, net tons	....	1,313	....
Wheat, bushels	16,086,194	18,617,797	27,248,292
Unclassified freight, net tons	55,937	51,748	53,185
Passengers, number	20,384	13,881	23,019

WEST BOUND

Items.	To Sept. 1, 1905.	To Sept. 1, 1904.	To Sept. 1, 1903.
Coal, anthracite, net tons	550,786	518,874	645,894
Coal, bituminous, net tons	3,427,034	2,355,166	3,976,210
Flour, barrels	7,175	107	30
Grain, bushels	1,533	625	1,000
Manufactured iron, net tons	65,829	69,904	88,569
Salt, barrels	257,206	248,837	255,253
Unclassified freight, net tons	408,955	285,485	307,945
Passengers, number	23,164	13,946	23,195

SUMMARY OF TOTAL FREIGHT MOVEMENT IN TONS.

	To Sept. 1, 1905.	To Sept. 1, 1904.	To Sept. 1, 1903.
East bound freight, all kinds, net tons	21,673,180	10,576,709	17,566,297
West bound freight, all kinds, net tons	4,491,619	4,266,266	5,061,873
Total freight, net tons	26,164,799	14,842,975	22,628 170

Total number of vessel passages to Sept. 1, 1905, was 13,077, and the registered tonnage, 21,710,816.

Coming into Duluth canal on Sunday night the steamer North Wind was driven by a wave against the pier and stove in her port bow. Tugs were signaled and the steamer attempted to get into the Northern Pacific slip, but sank when getting to dock. She will be raised at once and docked. The same storm smashed a protection pier on the Superior entry which was being built for the purpose of saving the new concrete. This was washed away for the second time this year.

AT THE HEAD OF THE LAKES

Duluth, Sept. 5.—The steel ship P. P. Miller bunted into the interstate drawbridge across the Duluth-Superior harbor Saturday, and put both ship and draw out of commission, though to both the damage was really quite small. The ship went to the dock of the Superior Ship Building Co.

There is a very large amount of ore tonnage always in harbor this summer, attributed by vesselmen to the failure of the mines to get ore down as fast as schedule. But in point of fact the mines and mining roads are up to their schedules, and the movement out of the docks of the Duluth, Missabe & Northern road last month was the largest on record and almost up to the facilities of the dock system. This is estimated by the company as 1,500,000 tons a month, and August's tonnage was 1,433,000 gross tons. The Duluth & Iron Range road moved about 1,250,000 tons and the Great Northern 700,000 tons, so that the Minnesota ore shipment for the month was 3,400,000 tons. The Mesabi range has shipped so far this year a total of 12,650,000 tons of ore, the Vermillion range 1,140,000. This is about the full season's figures for two or three years ago.

Grain receipts at the head of the lakes were larger in August, on account of the movement to Duluth of 500,000 bu. wheat from Minneapolis for eastern mills, and the commencement of the fall movement of new barley. Receipts for the month were 2,588,000 bu., shipments 2,336,000. New wheat is coming as an occasional carload only, but sales from the country of wheat "to arrive" have begun and the flood is expected during the present month. The same is true of flax. If half that is told of the new flax crop is correct there will be such a flood of it as has never been seen, and the wonder is what can be done with it. The talk now is for a crop in the region tributary to Duluth of about 29,000,000 to 30,000,000 bu., and the country's consumption is less than 20,000,000 per annum. There are somewhat less than 5,000,000 bu. seed, some of it three years old, in store here, which cost the owners all the way from 90 cents a bushel to $1.25 and more.

There is much interest in Superior in the announcement that the Superior Ship Building Co. had been awarded one of the new contracts taken by the American company for a large freighter. There is no work in sight for the yard aside from this. It is considered probable that two ships may be built here.

Work was commenced on the Osborne coal dock at Superior, the Clark Dredging Co. having put its men at work this week. Contracts for the superstructure have not been let.

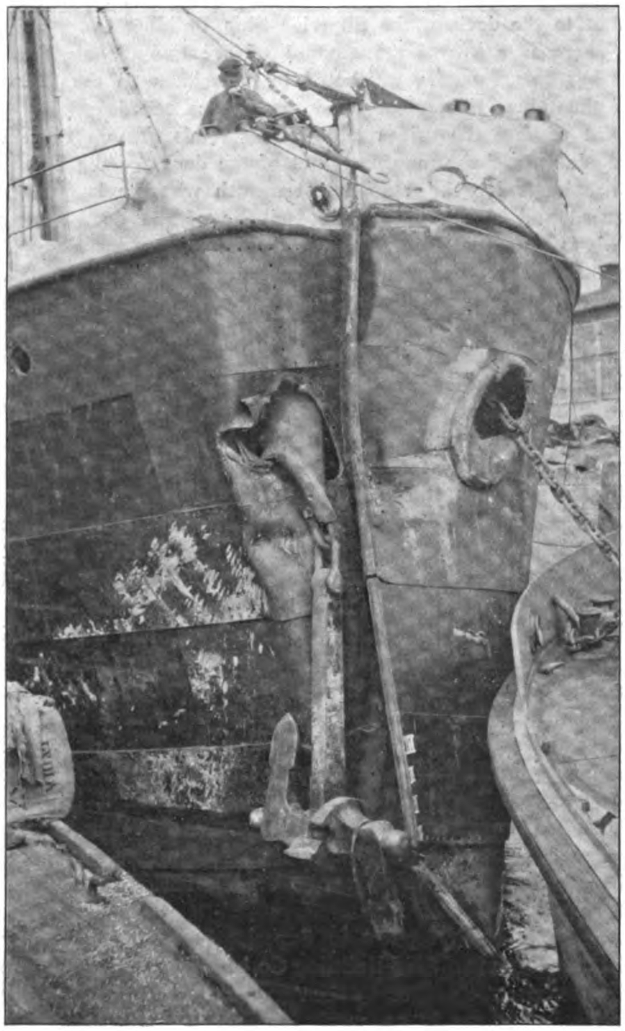
W. S. Cleaves, of Portage Lake, has been making extensive improvements to his marine machinery plant, and contemplates the erection of a large and modern drydock the coming year.

If ore business continues to increase at the present rate and the new ships become more and more common, it is probable that at least two more ore docks will be built at the head of the lakes the coming winter, or possibly a year later, and that one or two of those now in use will be torn down. If new ones are built they will probably be the largest and highest ever constructed. There has been some talk of figuring on steel construction for new docks, but this will scarcely come about yet. The final type and size is not yet definitely known.

E. G. Todt, formerly superintendent in the engine department of the Chicago Ship Building Co., South Chicago, has resigned to become vice president and general manager of the Gunnell Machine Co., Manitowoc, Wis., manufacturers of marine engines, propelling machinery, etc.

HEAD-ON COLLISION IN KAISER WILHELM CANAL

Accompanying this article are two pictures showing the effect of a head-on collision which happened on June 16 in the Kaiser Wilhelm canal. Both steamers were going at



STEAMER SKELLEFTEA.

low speed and when they tried to clear each other the steamer Stadt Schleswig did not obey the rudder. The pilot ordered full speed ahead in order to get steerage way but it was too late to avoid collision. The Schleswig struck the steamer Skelleftea on the starboard bow and while she lost her anchors (the broken shaft can be seen in the hawse pipe) and bent her bow, she also inflicted severe injuries to the Skelleptea.

FINE ENDORSEMENT OF PROPELLER WHEEL

The MacKinnon Manufacturing Co., Bay City, Mich., boiler makers, founders and machinists, have received a letter from Capt. Frank Elliott, master of the steamer Oregon which affords a striking endorsement of the propeller wheels manufactured by this company. Capt. Elliott writes as follows:

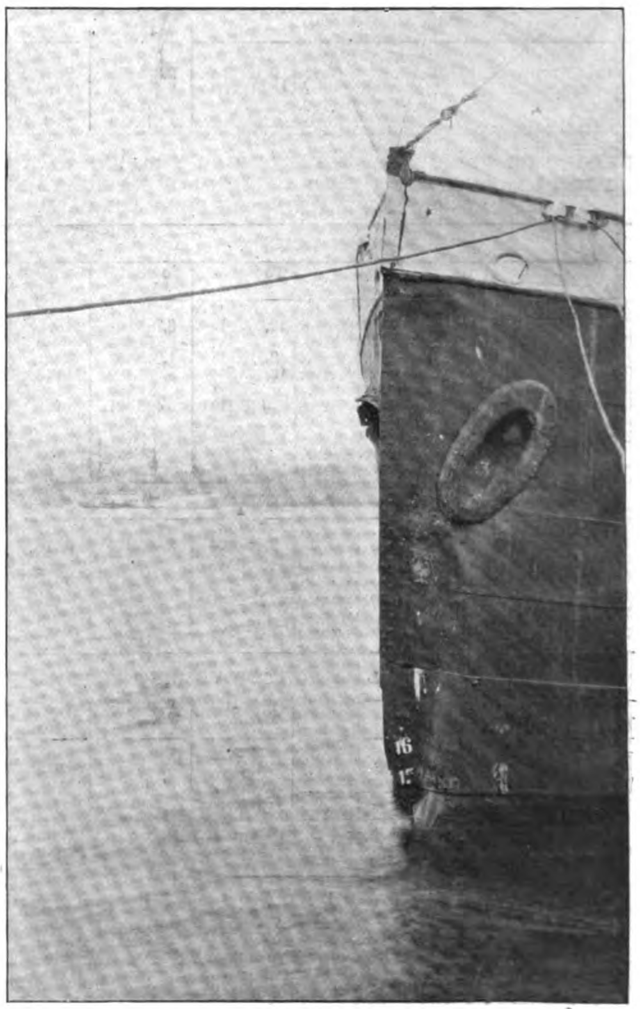
"Mr. H. D. MacKinnon, Bay City, Mich. Dear Sir—Your letter bearing date of Aug. 1 was handed me by Capt. J. A. Calbick, and will say that the wheel has proved a perfect success. I never was able to pull my barge over seven miles per hour until this summer, and it is no trouble for me to pull eight since I put on your wheel. Of course I did some work to our engine which has helped our time some, but take it all around, your wheel, for both running and pulling, can't be beat, and I think, without a doubt, you will get more orders from this company. I have also told all my friends who would be liable to want a wheel, our work is advertised enough and should give you a good boost in getting more orders. Yours very truly,

"CAPT. FRANK ELLIOTT."

CHANNEL FRAMING FOR TURBINE STEAMERS

The two turbine steamers to be built by Roach's ship yard, Chester, Pa., for the Metropolitan Steamship Co., of New York, as well as the turbine steamer building for the Eastern Steamship Co. at the same yard, will be constructed under special survey for the highest class in the United States Standard Register. The Metropolitan line steamers will have channel framing with the channel section split at the turn of the bilge to form bottom frame and reverse frame as patented by Mr. Sinclair Stuart, of the United States Standard Steamship Owners, Builders & Underwriters' Association, Ltd. This form of construction was adopted in the steamers Minnesota and Dakota of the Great Northern line, in the Shawmut and Tremont of the Boston Steamship Co.'s fleet and in the steamers built by the Maryland Steel Co. for the Atlantic Transport Co. It has been accepted by the British Corporation, Lloyd's Register and the United States Standard Register.

The United States cruiser Chicago, flagship of the Pacific coast squadron, started Aug. 24 for Puget Sound. She will



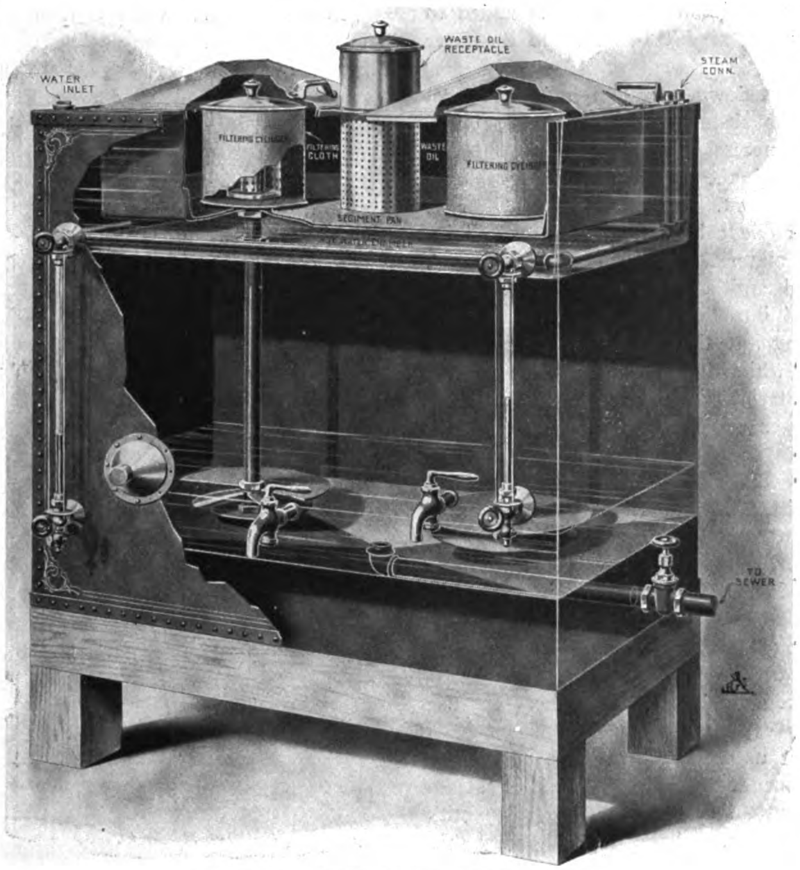
STEAMER STADT SCHLESWIG.

be placed in drydock at the Bremerton navy yard for the purpose of ascertaining whether she suffered any damage when she ran on the rocks of Angel island, San Francisco bay.

A UNIT TYPE OIL FILTER

The Burt Mfg. Co., Akron, O., have recently brought out a system of filtering oil in which a number of separate units may be connected together to filter the oil used in a large plant. Each unit is independent in itself, and new units may be added as the plant grows, thus keeping capacity of the oil filter system up to the size of the plant.

A sectional view of a single unit is shown in the accompanying illustration. The dirty oil enters the waste oil receptacle and passes through the small perforations, flowing thence horizontally to the two filtering cylinders, and in passing into these two cylinders, the heavy impurities fall by gravity into the sediment pan They are thus disposed of and do not clog the filtering cloths or filtering material. The filtering cylinders are wrapped with cloths through which the oil passes before entering the cylinders. The cylinders are filled with a quantity of animal bone black, through which the oil must flow before entering the two tubes which lead from the cylinders to the bottom of the filter. Two plates are attached to the bottom of the tubes and the oil is spread out in a very thin film by means of these plates.

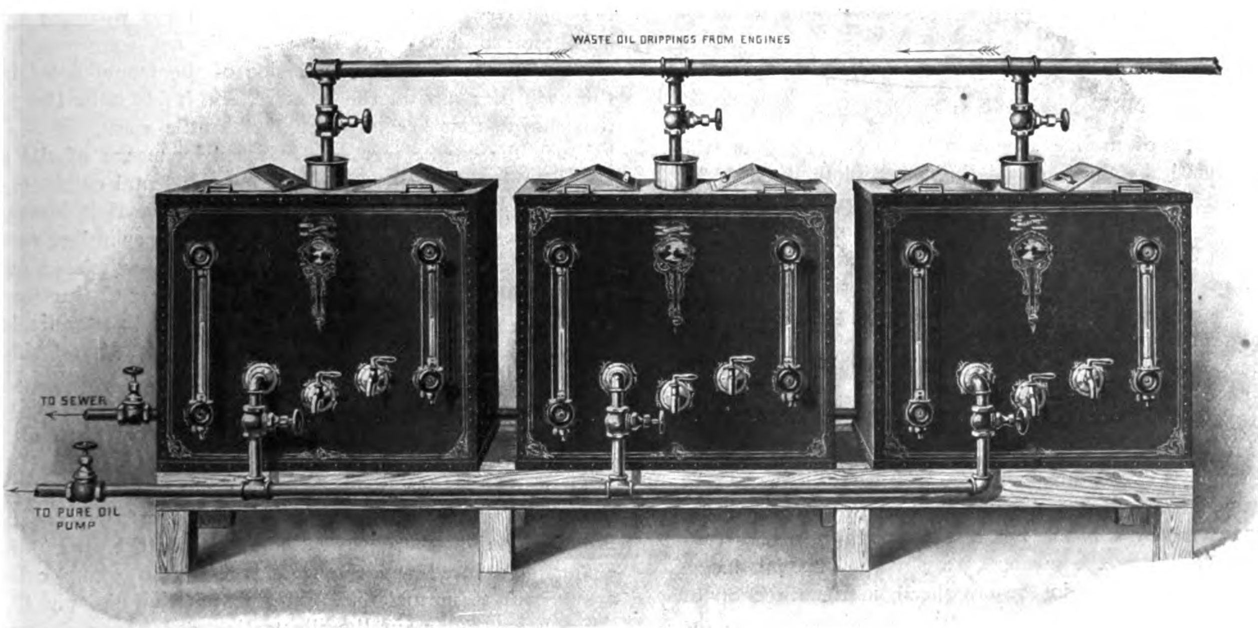


SECTIONAL VIEW OF OIL FILTER UNIT.

It is thus thoroughly washed by the water in the filter and any remaining impurities in the oil drop to the bottom of the filter and can be flushed out at any time desired by simply opening the gate valve, which connects with the sewer.

A hot water chamber surrounds the upper part of the filter which contains the filtering mechanism. The water in this chamber is heated by a small steam coil which is fed with live or exhaust steam, from any convenient source. The oil is thus heated before filtering and flows more freely, thereby increasing the speed of filtration and the filter capacity. When the dirty oil is heated it spreads out and most of the dirt and grit then falls into the sediment pan. The bulk of the sediment in this type of filter is at the top, where it can be readily removed without interfering in any way with the supply of pure oil for the oiling system. The maker guarantees that the filter will handle successfully the heaviest grades of oil, such as lard, gas engine and cylinder oil.

In the construction of the unit type of filter heavier iron is used than in the regular type of filter, and the body is riveted to a heavy wrought iron frame. All



OIL FILTERING PLANT CONSISTING OF THREE UNITS CONNECTED TOGETHER.

seams are lapped, riveted and soldered. The upper and lower part of the filter cylinders are made of cast iron, nickel plated on the top. The tubes leading from the filtering cylinders to the bottom of the filter are of wrought iron. The filter is painted dark blue, decorated with gold, and is an ornament to any first-class power plant.

The filters are so constructed that they may be used with or without an oiling system. They can, if desired, be installed and operated at first without being connected with an oiling system, and later on, if an oil system is added to the plant, pipe connections can readily be made to the filter at slight expense.

It is not necessary to shut down a system and disconnect pipe connections in order to clean the filter. If more than one unit is used it is only necessary to shut off the flow of oil to the filter to be cleaned, the other units being able to handle easily the extra amount. When only one filter is installed, the cloth around one cylinder can be removed instantly, and if the filtering material also needs to be removed, one cylinder is unscrewed and a plug which is furnished for the purpose is screwed into the tube, so as to keep the dirty waste oil from flowing into the filter. The other cylinder continues in operation while the first is being cleaned.

Any type of filtering material can be used in the cylinder, such as white waste, sponges, excelsior, raw wool, etc. The manufacturer recommends the use of animal bone black, which is in use in all oil refineries for purifying oil. This material can be washed with hot water or gasoline and used many times. Filtering cloths may also be used to purify the oil. As any number of cloths may be wrapped around the filtering cylinders and in changing them nothing but the cloths need be removed, the cloths can be removed while the filter is in operation without changing or touching any pipe connections.

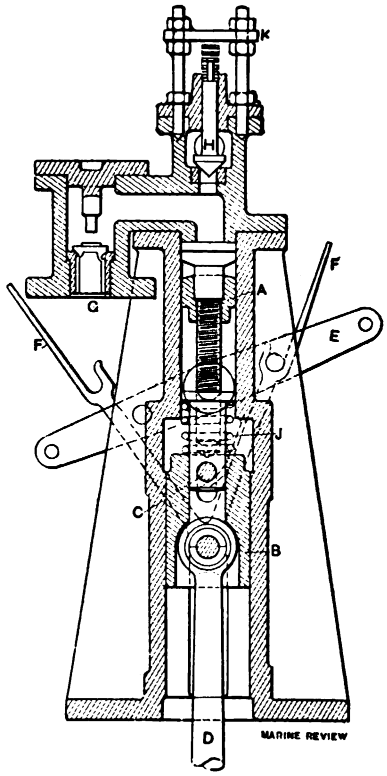
This type of filter is recommended by the makers for use with gas engines of large capacity, as the hot water from the engine cylinders can be used for the purpose of heating the oil. It is also recommended for use in gas or steam turbines, for the reason that an exceptionally large quantity of oil is used on these machines, and the oil being very thin will filter rapidly through this type of filter, owing to the effect of the hot water chamber at the top. It has been installed by a large number of prominent manufacturers in the United States. It has been largely adopted for use in the United States navy, and also the Japanese and Russian navies.

A NEW MARINE GOVERNOR

A new type of marine governor has been placed on the market recently by the Sheffield Engineers Limited, Sheffield, England. This governor is designed to overcome difficulties which have been discovered in the action of other marine governors, involving slowness of action and difficulty of attachment to existing engines. It is primarily designed to prevent racing of marine engines, when the propellor leaves the water or upon the breaking of the propellor shaft. The governor acts upon the principle that the power necessary to move water through a small aperture increases with the velocity of the water.

The governor is shown in the accompanying illustration. In the frame is cast a pump cylinder of 2 in. in diameter. In this frame is also cast a crosshead slide. The pump piston A is connected by a piston rod to the crosshead B; the connection is made by the means of a pin C. This pin has a slight motion in a slot in the crosshead, in the direction of the axis of the pston rod. This motion is independent of the movement of the pump piston. A connecting rod D joins the crosshead to the engine shaft or any other part of the engine which will give a reciprocating motion to the crosshead. At a central point on the frame of the governor is mounted a lever E. This lever is arranged to have a slight rotation about a pin at its center, and is joined to the throttle valve by wires or chains running from its extremities. It is operated by means of a two-armed tappet lever F, which is pivoted on the crosshead pin.

The operation of the governor is as follows: When the pump piston A is operated by the engine, water is drawn through a suction valve G from a small tank. This water is



delivered back to the tank through a valve H. This valve is so arranged as to form an adjustable opening. When the engine is running at normal speed the crosshead and pump piston move in unison. They are kept in their extreme relative position by means of a spiral spring J. On the tappet lever F is a small piece which acts with the crosshead pin, so that when the spring is not compressed the forked end on the right hand side of the tappet lever is in the path of a pin on the lever E, and holds it in the position shown, thus keeping open the throttle valve.

When the engine increases in speed by means of the propeller leaving the water, or any other accidental cause, resistance to the passage of water through the valve H is increased. This causes a greater pressure in the pump cylinder, so that the pump travels somewhat slower than the crosshead owing to the compression of the spring J. The pin C thus moves along the slot in the crosshead and throws the tappet lever F to such a position that the fork on the left hand side of the lever engages the pin on that side of the lever E. Upon the completion of the stroke the lever E is rotated to a position opposite, as shown in the illustration, thus closing the throttle valve and slowing down the engine.

The tappet lever remains in such a position as to keep the throttle valve closed just so long as the increased resistance is maintained in the pump cylinder. When the speed of the engine is reduced and the resistance in the pump cylinder comes back to normal the spring J will bring the pin C into the position shown in the illustration and cause the tappet lever to return to its original position, and then will engage with the pin on the right hand end of the lever and move

it to the position shown in the illustration, thus reopening the throttle.

Mounted above the valve H is a spring and bridge K which enables the latter to act as a relief valve. The approximate outside dimensions of the governor are 20 in. x 9 in. x 10 in., and the weight of the governor is about 100 pounds.

RUSSIAN SAILING VESSELS

A list of Russian sailing vessels of 75 tons and upwards has just been published at Riga by Mr. A. Bandrewitch, and attached to it is an introduction giving particulars of the development and present position of the building of small wooden sailing ships along the Baltic coast. The list contains some hundreds of these craft, and the accompanying statistics show that the construction of these small ships is still going on. Last year, however, it was not so brisk, owing probably to the war and the circumstances arising from it: only fourteen small sailers, measuring altogether 2,956 registered tons, having been built, against twenty (4,507 tons) in 1903, thirty-three (6,220 tons) in 1902, and thirty-six (6,745 tons) in 1901. This fleet of sailing ships is, of course, of no importance from an international point of view, nevertheless the reproduction of a few of the remarks made upon it will probably not be without interest.

In the first place we are told that up to the 70's of last century the trading firms of Riga, Windau, and Libau were exclusively the owners of merchant vessels in the Baltic provinces, and even later than that some of these firms have been the possessors of a large number of sailing ships. The members of these firms also acted as experts in maritime affairs on the exchange committees at the ports where they resided. Early in the 70's, however, this state of things was altered. On the initiative of the Grand Duke Constantine, seamen's training schools were founded at various places on the coast according to the plan of C. Waldemar, who was likewise the originator of the scheme for the formation of the Volunteer fleet. A road was thus opened to the dwellers on the coast, especially the fishermen, for a thorough sea training. This movement was fostered and assisted by the Society for the Development of the Russian Mercantile Navy, formed at Moscow in 1873, and in a short time about forty training schools for seamen came into existence. Navigation schools for the training of officers were also established to the number of four, but by virtue of a law passed in 1902 three of these were abolished, an only one was left, that at Haynasch, and the chances of the poorer inhabitants of the coast becoming experienced navigators were much diminished.

That which had been accomplished, however, in the way of maritime training for the coast population had the effect of arousing an interest in the construction of small sea-going craft, and by a gradual process the whole Baltic sailing fleet quitted the possession of the trading firms and became the property of the inhabitants of the coast, and by the same process those firms lost touch with the maritime circles and the exchange committees.

In 1904 the administration for Russian Maritime Trade and Seaports returned the cost price of the 875 sailing ships registered in the Baltic ports, measuring altogether 103,527 registered tons net, at 5.6 million roubles, being equal to about 62½ roubles per ton. The craft included in the above-mentioned list are mostly ships built within the last ten years, the value of which is estimated at a higher figure than that just quoted, namely, from 75 to 85 roubles per ton. The present cost of building, however, is put at 95 to 110 roubles per ton, if built on the coast, and at a somewhat higher figure if built in the seaports.

WORLD'S FOUR GREATEST NAVIES

Editor *Marine Review*: The United States now holds fourth place as a naval power, with 316,523 registered tons. Germany holds third place with, according to the *Hamburger Nachrichten*, 341,243 tons. The United States has 324,500 warship tonnage under construction, says the same paper, and Germany has 126,557 tons. When the war vessels now building by each are completed, the United States will have a warship tonnage of 641,023 and Germany will have 467,800. This will put the United States in third place, with a lead over Germany of 173,223 tons.

France has a present war tonnage of 603,721, with 170,279, a total of 774,000, or 306,200 tons more than Germany. The combined lead of the United States and France will be 947,223 tons.

Great Britain has 1,593,871 tons in use, and 338,129 tons building, a total of 1,932,000 tons. When all the warship construction now under way by the four countries is completed, the world's four greatest navies will line up, as follows: Great Britain, 1,932,000 registered tonnage; France, 774,000 registered tonnage; United States, 641,023 registered tonnage; Germany, 467,800 registered tonnage.

Schenectady, N. Y. WALTER J. BALLARD.

A WORD OF APPRECIATION.

President Pro Tempore
United States Senate.

Mr. Harvey D. Goulder,
President Merchant Marine League.

My Dear Sir:

I have just had an interview with Mr. A. R. Smith, commissioner of the Merchant Marine League, of which you are president. You have entered upon a very important work and seem to be pushing it vigorously. I am glad to have help in my endeavor to restore our Merchant Marine to its proper position on the ocean from the mid-West, and to find at the head of this association a gentleman for whose ability I have such high respect.

Your commissioner, Mr. Smith, is a hustler, and has been of great aid to me in the past, and there is no limit to the amount of intelligent work he will do.

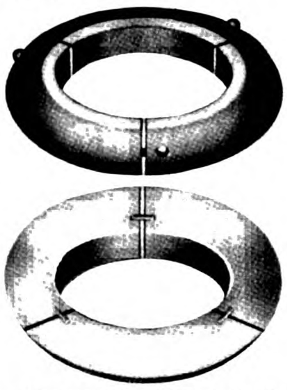
I am, Very truly yours,
WM. P. FRYE.

Lewiston, Me., Aug. 24, 1905.

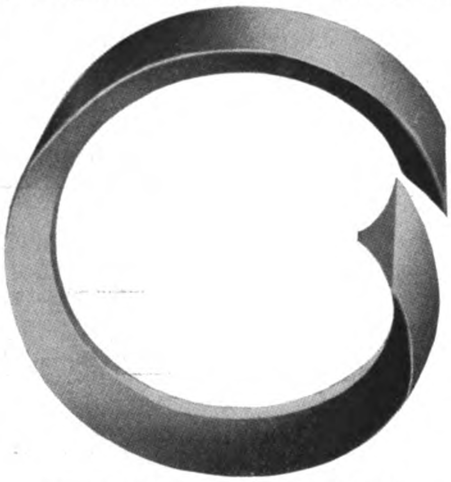
For some time past the Union Iron Works of San Francisco have been making extensive repairs on the Russian converted cruiser Lena, which has been interned at the Mare Island navy yard since September, 1904. Much of the cruiser's machinery has been removed and taken to the shipyards of the Union Iron Works. The crew has done as much as possible in repairing the vessel, which will return to Russia as soon the arrangements between Japan and Russia permit. On Aug. 9 the Lena, escorted by the torpedo boat Fox and the tug Wheeler, made a trial trip in San Francisco bay. She was permitted to go anywhere within the limits of the bay but not outside the Heads. She returned to Mare island on the morning of the 10th.

A NEW FORM OF METALLIC PACKING

The Goodyear Tire & Rubber Co., Akron, O., have recently brought out a new form of metallic packing, which is illustrated herewith. This packing can be applied to any rod or valve stem without trouble or loss of time. The packing is made of two materials, metal and rubber. The actual packing is done by the metal pieces, the rubber acting merely as a cushion for the metal part, and does not touch the rod. The metal portion is made in the form of a ring which is broken into three pieces. The cross section of this ring is roughly the quadrant of a circle. Two rings are placed together so as to break joints. The rubber ring is then placed between each pair of metal rings and the hole tightened up in the stuffing box.

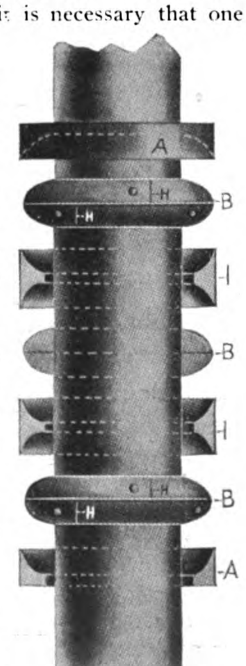


METAL PACKING RING, GOODYEAR METALLIC PACKING.



RUBBER CUSHION-RING, GOODYEAR METALLIC PACKING.

In packing, a half ring of rubber "A" is first placed in the stuffing box. The metal ring "B" is next placed on the rod so that the beveled side will fit into the offset in the ring "A." To place the metal rings it is necessary that one of the small copper wires "C" joining the various portions of the ring be cut, which will permit of the ring being spread so that it can be easily placed around the rod. A second metal ring is placed on the first with the flat sides of the two together, care being taken to see that the joints are broken. A complete rubber ring "I" is then placed over the metal ring, and so on until the stuffing box is filled. A half rubber ring "A" is placed at the outer end of the stuffing box. The gland of the stuffing box is turned up with hand so that it rests firmly against the packing. If there is any leakage when first starting the engine, the packing will soon adjust itself without tightening the stuffing box.



GOODYEAR METALLIC PACKING.

The maker states that it is a perfect packing for steam, air, ammonia, oil, water, and glass. It has been installed in a number of plants and has held under very severe conditions. For instance, at the Carnegie Steel Works great difficulty was experienced in packing a large steam hammer. The packing rarely lasted over nine days. Packing of this type was tried and ran sixty days without being renewed. The maker guarantees the packing to hold for one year, it having been tried in the shop for that length of time before being placed on the market for any given service.

TRADE NOTES

The Falls Hollow Staybolt Co. have orders for hollow staybolt iron bars for export to the Imperial railway of North China and a leading railway of Japan.

Charles Cory & Son are furnishing material and installing complete the interior means of communication, Battle & Range order signals, comprising telephones, electrical engines, steering and helm order telegraphs, speed and direction revolution indicators, fire alarm systems, general alarm systems, speaking tubes and call bells on the following naval vessels: Charleston, Virginia, Louisiana, Minnesota, Washington, Kansas, Georgia, St. Louis.

The Wilcox Manufacturing Co. of Aurora, Ill., has increased its capacity in the overhead trolley track department by enlarging its plant and installing heavy machinery for the manufacture of all types of cranes. At the head of the engineering department has been placed Mr. C. F. Blake, a member of the A. S. M. E., formerly with the Shaw Electric Crane Co., Muskegon, Mich., who has had many years' successful experience in designing and erecting cranes of all descriptions.

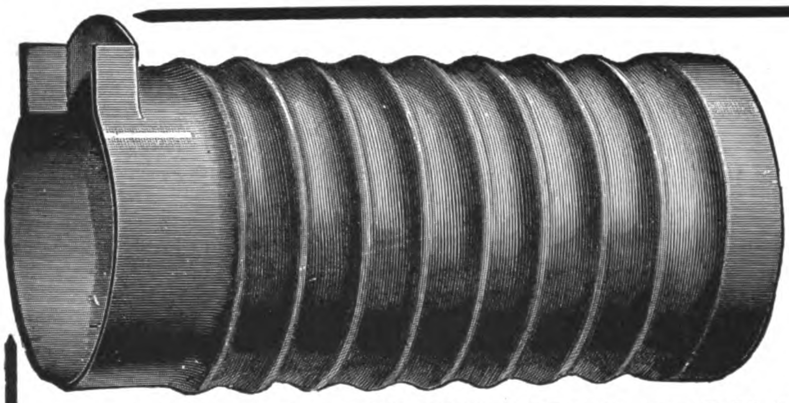
The combination of modern cranes with its overhead trolley system, says the Wilcox company, places it in position to make bids on equipment to hoist and transport "anything anywhere any time."

The advent of the independent air pump and condenser has had much to do with the practical development of the compound engine in medium and small sizes for with this combination there are now obtainable economic results which not long since were expected only from the large compound engine with direct connected air pump. It is seldom that a non-condensing plant can be found where an increase of 20 to 30 percent in the output cannot be obtained coincidently with a reduction of 15 to 25 percent in the steam consumed per horse-power. The convenience of application and operation of the separate condenser are appreciated by every engineer. That the jet and the surface type have their respective fields, is clearly recognized. Both designs in a full line of sizes are now being manufactured by the W. H. Blake Steam Pump Co., of Hyde Park, Mass. They range in capacity from 600 to 40,000 pounds of steam condensed per hour with injection water at 70 degrees F.

Elisha Webb Jr., of Elisha Webb & Son, Philadelphia, manufacturers of steamship equipment, leaves on the 25th inst. for an extended trip along the lakes from Buffalo to Duluth, thence by rail to Seattle, Tacoma, Portland and San Francisco, for the purpose of renewing acquaintances and making new friends and customers for his firm, whose clients in the West have increased to such an extent that a periodical visit is as pleasant as it is profitable. The many specialties manufactured by Messrs. Elisha Webb & Son for the equipment of vessels, makes their line not only desirable but interesting to ship builders and owners. The demand for the "Webb Perfection Circulating System" for supplying hot and cold water on shipboard in connection with their galley ranges, has far exceeded their most sanguine expectations. This departure from the ordinary methods of supplying this necessary commodity on shipboard, is explained at considerable length in a pamphlet describing the apparatus, which the firm is publishing and will be mailed upon application. A trip to Yellowstone Park for a little recreation will be a feature of Mr. Webb's trip.

ENGINEERS' NUMBER

VOL. XXXII. CLEVELAND, SEPTEMBER 7, 1905. No. 10.



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For Land and Marine Boilers

Uniform Thickness—Easily Cleaned
UNEXCELLED FOR STRENGTH

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Manufactured by **THE CONTINENTAL IRON WORKS,** West and Cayler Sts., NEW YORK.
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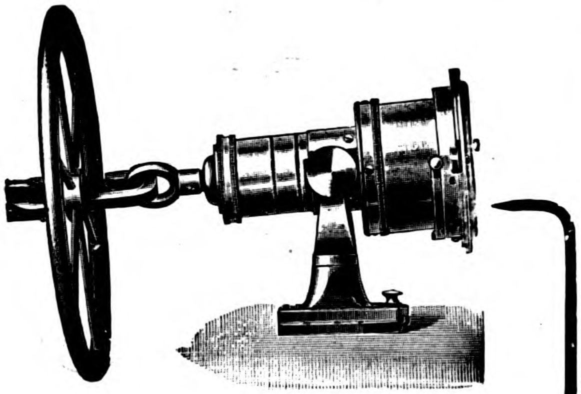

THE "NEPTUNE" LOG

The "Neptune" Ship Log has ball bearings for high speeds. We also make the "CHERUB" and "HARPOON" Ship Logs.

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Bridge Unloaders
for rapidly discharging bulk cargoes from vessels directly to cars to storage on docks.

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for rapidly handling either bulk or package freight.

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These Blocks Save the Rope and Outwear all others.

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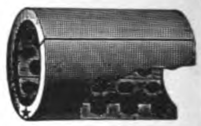

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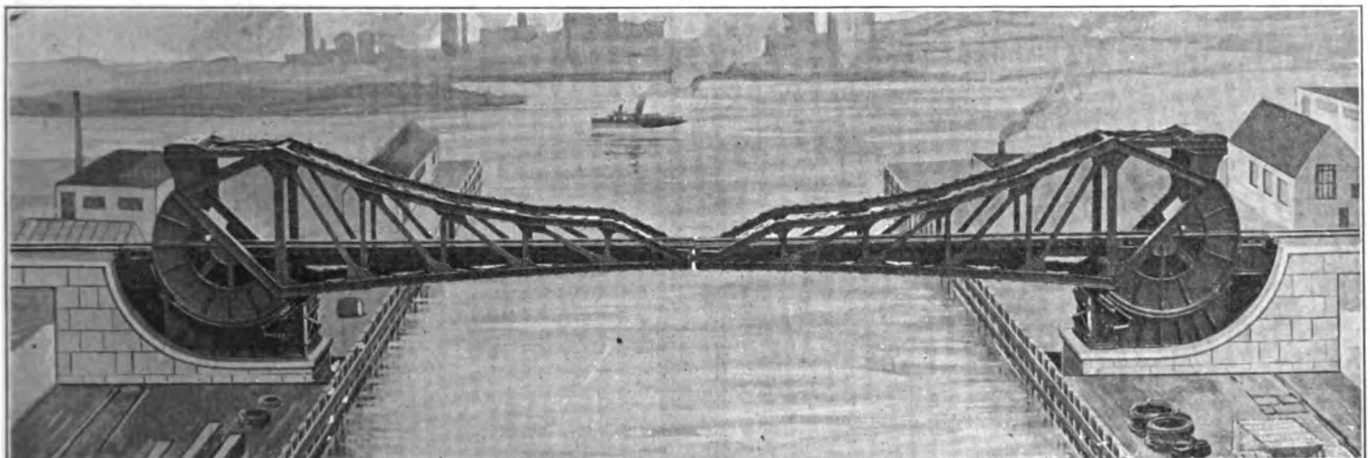

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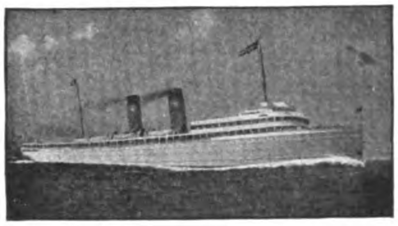

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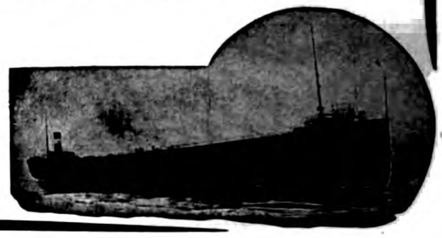

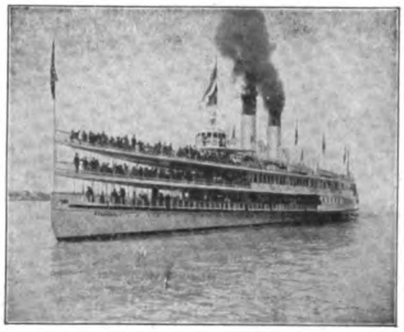

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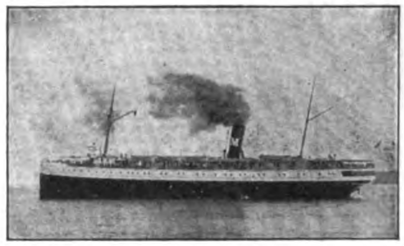

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ANY SIZE

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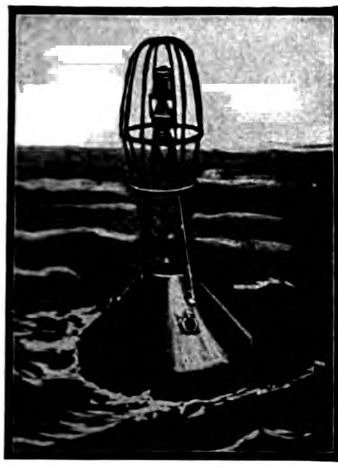

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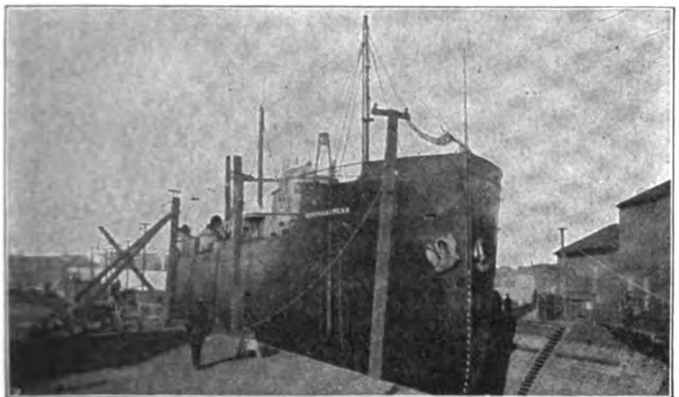

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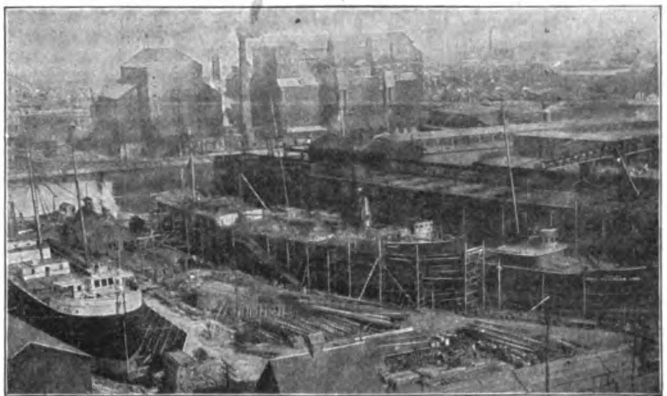

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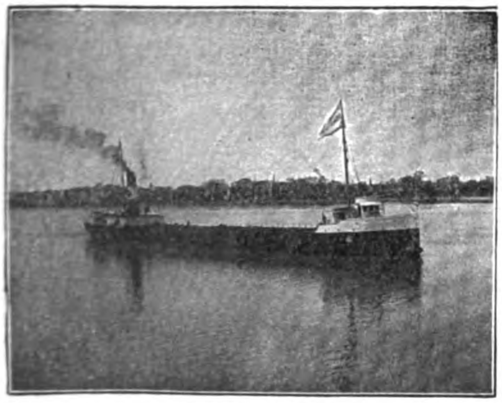

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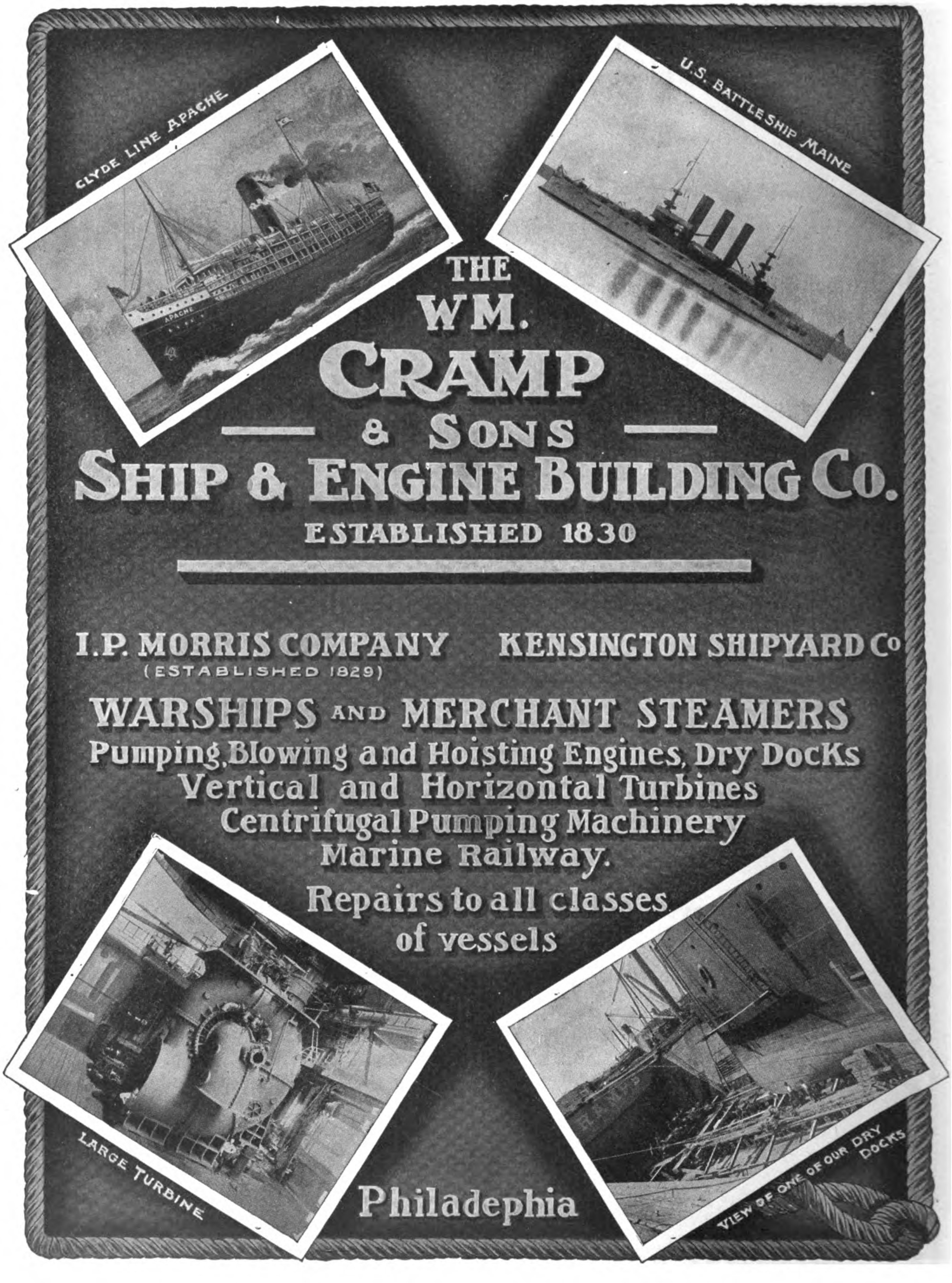
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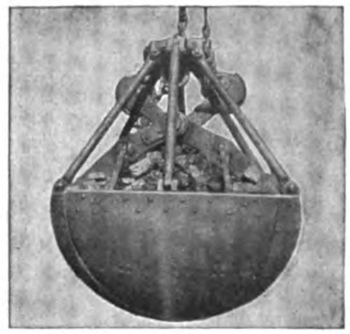

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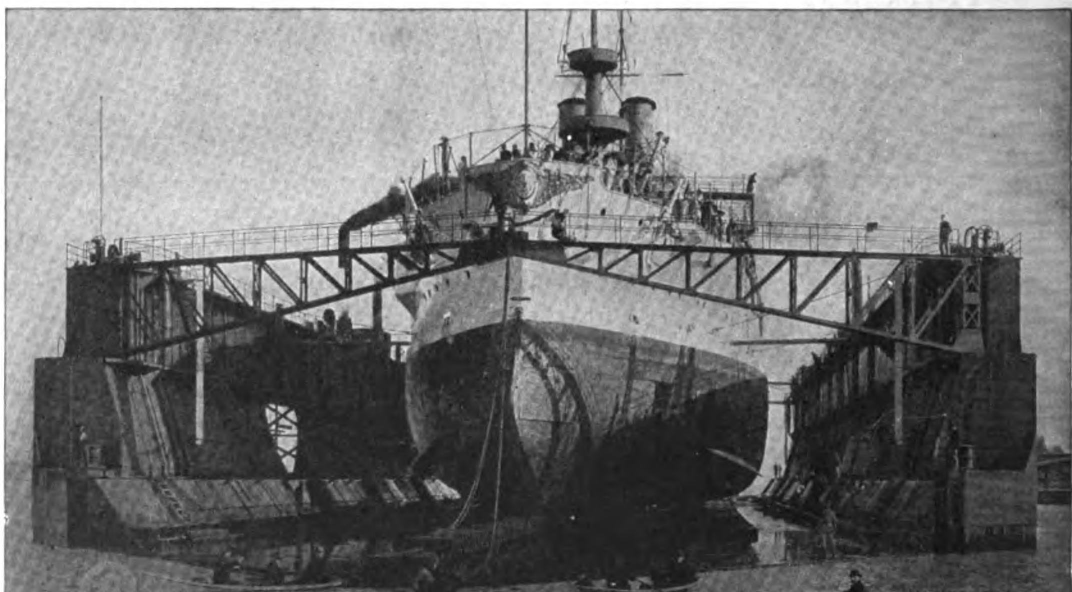

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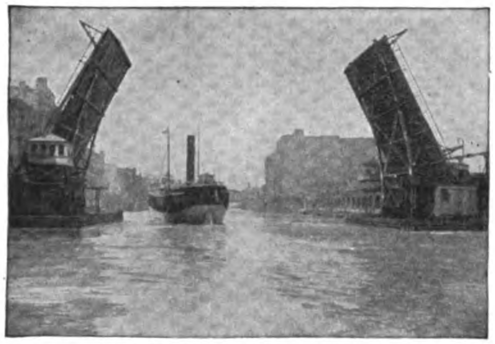

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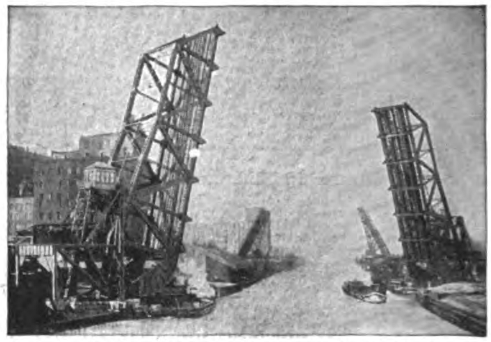

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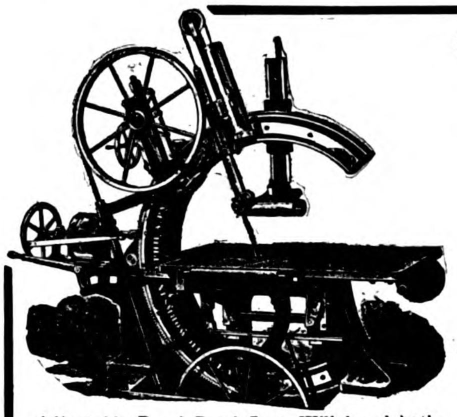

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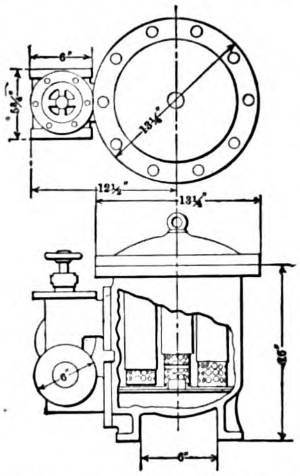

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REFLEX FILTERS

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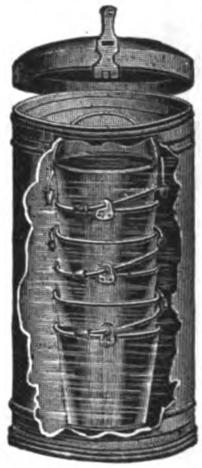

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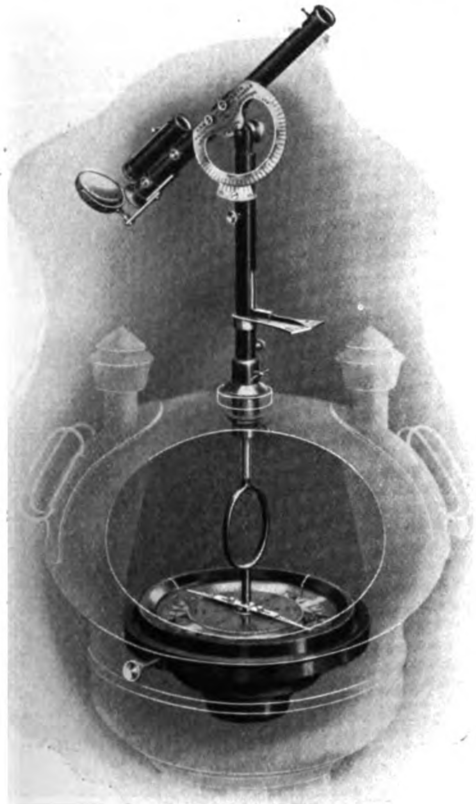

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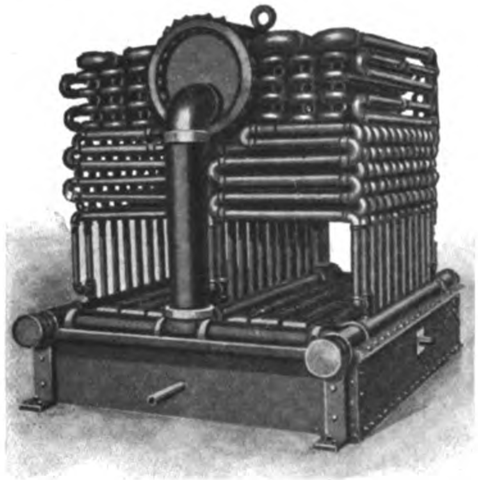
BOSTON - MASS.



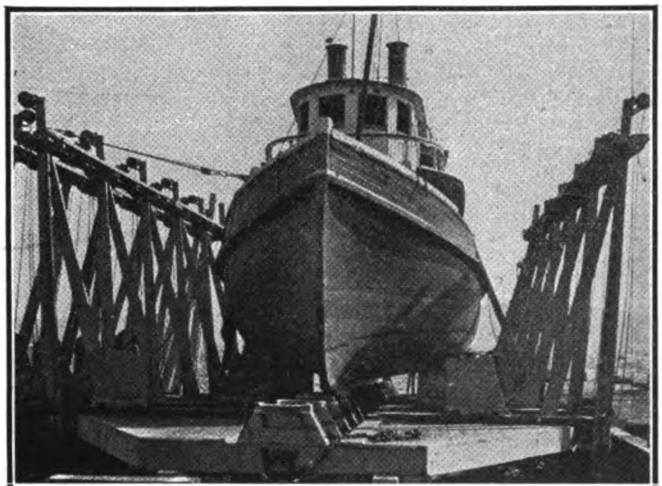
CAPACITY of production, durability and fuel economy are the three distinguishing points of superiority which predominate

DEARING WATER-TUBE BOILERS

For further information

Dearing Water-Tube Boiler Co.

Dept. C. DETROIT, MICH.



RAILWAY DRY DOCKS

STEEL AND TIMBER CONSTRUCTION

Safe, Rapid, Convenient, Reliable, Economical

H. I. Crandall & Son Co.

Engineers and Contractors

East Boston Mass.

BELLEVILLE WATER-TUBE BOILERS

NOW IN USE (MARCH, 1905)

On Board Sea-going Vessels, NOT INCLUDING New Installations Building or Erecting.

French Navy	360,560	H. P.
English Royal Navy	966,300	"
Russian Imperial Navy	253,800	"
Japanese Imperial Navy	122,700	"
Austrian Imperial Navy	56,700	"
Italian Royal Navy	32,500	"
Chilian Navy	26,500	"
Argentine Navy	13,000	"
The "Messageries Maritimes" Company	87,600	"
Chemins de fer de l'Ouest: (The French Western Railway Co.) Steamships plying between Dieppe and Newhaven	18,500	"
Compagnie Generale Transatlantique	1,500	"
Total Horse Power of Boilers in Use	1,939,660	

Societé Anonyme des Etablissements Delaunay Belleville

CAPITAL: 6,000,000 FRANCS

Works and Dock Yards of the Ermitage at Saint-Denis (Seine), France. Telegraphic Address: Belleville, Saint-Denis-Sur-Seine

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Geo. L. McCurdy

169 Jackson Boulevard

CHICAGO ILLINOIS

INSURANCE

HULLS and CARGOES

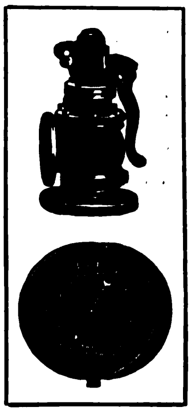
DIRECT REPRESENTATIVE OF LEADING AMERICAN AND FOREIGN UNDERWRITERS

TUBES

For shipment immediately on receipt of order we have in stock a complete assortment of Boiler Tubes, 2" to 5" inclusive — various lengths.

See monthly stocklist.

THE BOURNE-FULLER CO.
IRON STEEL
PIG IRON
COKE
Cleveland, Ohio.



ASHTON

Cam Lever Pop Safety Valves and Non-Corrosive Steam Gauges.

give highest efficiency and durability.
Specify them and get the best.

The Ashton Valve Co.
Boston New York Chicago
U. S. A.

Buyers' Directory of the Marine Trade

For a more complete classification than that represented by advertisers in the Marine Review, see the BLUE BOOK OF AMERICAN SHIPPING, marine and naval directory of the United States, published by The Marine Review, Cleveland.

See accompanying index of Advertisers for full addresses of concerns in this directory.

AIR COMPRESSORS, AIR HOISTS, ETC.
Great Lakes Engineering Works......Detroit.
Mietz, Aug. ....New York.

AIR PORTS, DEAD LIGHTS, ETC.
Marine Mfg. & Supply Co.........New York.

AIR PUMPS AND APPLIANCES.
Fore River Ship & Engine Co..Quincy, Mass.
Great Lakes Engineering Works......Detroit.

ANCHORS.
Bowers, L. M. & Co.......Binghamton, N. Y.

ANTI-FRICTION METALS.
Cramp, Wm. & Sons............Philadelphia.

ARTIFICIAL DRAFT FOR BOILERS.
American Ship Building Co.........Cleveland.
Detroit Ship Building Co.............Detroit
Great Lakes Engineering Works......Detroit
Sturtevant, B. F., Co.......Hyde Park, Mass.

ASH EJECTORS.
Great Lakes Engineering Works......Detroit.

ATTORNEYS AND PROCTORS IN ADMIRALTY.
Gilchrist, Albert J................Cleveland.
Goulder, Holding & Masten........Cleveland.
Hoyt, Dustin & Kelley............Cleveland.
Jenkins, Russell & Eichelberger....Cleveland.
Kremer, C. E.......................Chicago.
MacDonald, Ray G...................Chicago.
Shaw, Warren, Cady & Oakes........Detroit.
White, Johnson, McCaslin & Cannon Cleveland

BAROMETERS, MARINE GLASSES, ETC.
Ritchie, E. S. & Sons.......Brookline, Mass.

BELT CONVEYORS.
Link Belt Machinery Co.............Chicago.

BLOCKS, SHEAVES, ETC.
Boston & Lockport Block Co.....Boston, Mass.
Cleveland Block Co...............Cleveland.

BLOWERS.
Power Specialty Co..................Detroit.
Sturtevant, B. F. Co.......Hyde Park, Mass.

BOAT BUILDERS.
Drein, Thos. & Son.........Wilmington, Del.
Kahnweiler's Sons, David.........New York.
Lane & DeGroot....Long Island City, N. Y.
Marine Construction & D. D. Co..........
..........Mariner's Harbor, S. I., N. Y.
Truscott Boat Mfg. Co.....St. Joseph, Mich.
Willard, Chas. P. & Co. Winthrop Harbor, Ill.

BOILER CLEANING DEVICE.
Power Specialty Co..................Detroit.

BOILER COMPOUNDS.
Dearborn Drug & Chemical Works....Chicago.

BOILER MANUFACTURERS.
Almy Water Tube Boiler Co..Providence, R. I.
American Ship Building Co.........Cleveland.
Atlantic Works..........East Boston, Mass.
Chicago Ship Building Co...........Chicago.
Cramp, Wm. & Sons...........Philadelphia.
Dearing Water Tube Boiler Co.........Detroit.
Delauney, Belleville & Co...St. Denis, France.
Detroit Ship Building Co............Detroit.
East End Boiler Works.............Detroit.
Fletcher, W. A. & Co.........Hoboken, N. J.
Fore River Shipbuilding Co.....Quincy, Mass.
Great Lakes Engineering Works......Detroit.
Kingsford Foundry & Machine Works....
........................Oswego, N. Y.
Marine Iron Works..................Chicago.
Maryland Steel Co.......Sparrows Point, Md.
Milwaukee Dry Dock Co..........Milwaukee.
Mosher Water Tube Boiler Co....New York.
Newport News Ship Building Co.........
....................Newport News, Va.

BOILER MANUFACTURERS—Continued.
New York Shipbuilding Co.....Camden, N. J.
Northwestern Steam Boiler & Mfg. Co....
........................Duluth, Minn.
Quintard Iron Works Co...........New York.
Roberts Safety Water Tube Boiler Co....
..............................New York.
Stirling, The Co................. New York.
Superior Ship Building Co.....Superior, Wis.
Taylor Water Tube Boiler Co........Detroit.

BOILER RIVETS.
Bourne-Fuller Co.................Cleveland.

BOILER STAYBOLTS, IRON OR STEEL, HOLLOW OR SOLID.
Falls Hollow Staybolt Co..Cuyahoga Falls, O.

BRASS AND BRONZE CASTINGS.
Cramp, Wm. & Sons............Philadelphia.
Fore River Ship & Engine Co..Quincy, Mass.
Great Lakes Engineering Works......Detroit.
Lunkenheimer Co...................Cincinnati.
Macbeth Iron Co..................Cleveland.

BRIDGES, BUILDERS OF.
Cowing, John P...................Cleveland.
Scherzer Rolling Lift Bridge Co.....Chicago.

BUCKETS, ORE AND COAL.
Brown Hoisting & Conveying Machine Co.
.... Cleveland.
McMyler Mfg. Co................Cleveland.
Mayo & Bailey ....Chicago.

BULKHEAD DOORS, WATERTIGHT.
"Long Arm" System Co..........Cleveland.

CABIN AND CABINET FINISHING WOODS.
Martin-Barriss Co..................Cleveland.

CANVAS SPECIALTIES.
Baker & Co., H. H...................Buffalo.
Bunker, E. A. ....New York.
Upson-Walton Co..................Cleveland.

CAPSTANS.
American Ship Windlass Co..Providence, R. I.
Hyde Windlass Co.................Bath, Me.
Marine Mfg. & Supply Co.........New York.

CEMENT, IRON FOR REPAIRING LEAKS.
Smooth-On Mfg. Co.........Jersey City, N. J.

CHAINS.
Woodhouse Chain Works......Trenton, N. J.

CHAIN CONVEYORS, HOISTS.
Brown Hoisting Machinery Co. (Inc.)....
.... Cleveland.
General Electric Co........Schenectady, N. Y.

CHAIN HOISTS.
Boston & Lockport Block Co....Boston, Mass.

CHARTS.
Penton Publishing Co.............Cleveland.
Potter, J. D.........................London.

CLOCKS (Marine and Ship's Bell) AND CHRONOMETERS.
Ashton Valve Co.....................Boston.
Ritchie, E. S. & Sons........Brookline, Mass.

COAL PRODUCERS AND SHIPPERS.
Hanna, M. A. & Co..............Cleveland.
Ironville Dock & Coal Co.........Toledo, O.
Pickands, Mather & Co............Cleveland.
Pittsburg Coal Co.................Cleveland.

COAL AND ORE HANDLING MACHINERY.
Brown Hoisting Machinery Co. (Inc.)....
.... Cleveland.
Link Belt Machinery Co............Chicago.
McMyler Mfg. Co.................Cleveland.

COMPASSES.
Ritchie, E. S. & Sons........Brookline, Mass.

COMPASS CORRECTORS.
How, Benj. V.......................... Boston.

CONDENSERS.
Great Lakes Engineering Works......Detroit.
Thropp & Sons Co., John E...Trenton, N. J.

CONTRACTORS FOR PUBLIC WORKS.
Breymann & Bros., G. H.............Toledo.
Buffalo Dredging Co.................Buffalo.
Dunbar & Sullivan Dredging Co.....Buffalo.
Fitz-Simons & Connell Co...........Chicago.
Great Lakes Dredge & Dock Co.....Chicago.
Hickler Bros.......Sault Ste. Marie, Mich.
Hubbell Co., H. W...............Saginaw, Mich.
Lake Superior Contracting & Dredging Co.,
.... Duluth, Minn.
Smith Co., L. P. & J. A............Cleveland.
Starke Dredge & Dock Co., C. H..Milwaukee.
Sullivan, M..........................Detroit.

CORDAGE.
Baker & Co., H. H...................Buffalo.
Upson-Walton Co..................Cleveland.

CORK JACKETS AND RINGS.
Armstrong Cork Co............Pittsburg, Pa.
Kahnweiler's Sons, D.............New York.

CRANES, TRAVELING.
Brown Hoisting Machinery Co......Cleveland.
McMyler Mfg. Co.................Cleveland.

DIVING APPARATUS.
Morse, A. J. & Son..................Boston.
Schrader's Son, Inc., A....... ... New York.

DRAFT, MECHANICAL.
Sturtevant Co., B. F...........Hyde Park, Mass.

DREDGING CONTRACTORS.
Breymann & Bros., G. H.............Toledo.
Buffalo Dredging Co................Buffalo.
Dunbar & Sullivan Dredging Co......Buffalo.
Fitz-Simons & Connell Co...........Chicago.
Great Lakes Dredge & Dock Co.....Chicago.
Hickler Bros..........Sault Ste. Marie, Mich.
Hubbell Co., H. W...............Saginaw, Mich.
Lake Superior Contracting & Dredging Co.
.... Duluth, Minn.
Smith Co., L. P. & J. A..........Cleveland.
Starke Dredge & Dock Co., C. H..Milwaukee.
Sullivan, M..........................Detroit.

DREDGING MACHINERY.
Quintard Iron Works Co...........New York.

DRYING APPARATUS.
Sturtevant, B. F. Co.......Hyde Park, Mass.

DRY DOCKS.
American Ship Building Co.........Cleveland.
Atlantic Works...........East Boston, Mass.
Buffalo Dry Dock Co.................Buffalo.
Chicago Ship Building Co............Chicago.
Craig Ship Building Co...........Toledo, O.
Cramp, Wm. & Sons...........Philadelphia.
Detroit Ship Building Co.............Detroit.
Great Lakes Engineering Works......Detroit.
Lockwood Mfg. Co.......East Boston, Mass.
Milwaukee Dry Dock Co............Milwaukee.
Newport News Ship Building Co........
.....................Newport News, Va.
Shipowners Dry Dock Co............Chicago.
Superior Ship Building Co.....Superior, Wis.
Tietjen & Lang Dry Dock Co.....Hoboken, N. J.

DREDGE BUILDERS.
Manitowoc Dry Dock Co........Manitowoc, Wis.

DYNAMOS.
General Electric Co...........Schenectady, N. Y.
Mietz, Aug..........................New York.
Sturtevant, B. F. & Co.........Hyde Park, Mass.
Thropp & Sons, John E...........Trenton, N. J.

ECONOMIZERS, FUEL.
Sturtevant Co., B. F...........Hyde Park, Mass.

ELECTRIC HOISTS AND CRANES.
General Electric Co........Schenectady, N. Y.

WANTED and FOR SALE Department.

PROPOSALS.

U. S. ENGINEER OFFICE, Duluth, Minn., Aug. 19, 1905. Sealed proposals for U. S. Engineer Building at Duluth, Minn., will be received here until noon, Sept. 18, 1905, and then publicly opened. Information on application. CHAS. L. POTTER, Major Engrs. Sept. 14.

U. S. ENGINEER OFFICE, 57 Park St., Grand Rapids, Mich., Aug. 21, 1905. Sealed proposals for repair of Pier and Revetments at Charlevoix, Mich., will be received here until 3 p.m., Sept. 20, 1905, and then publicly opened. Information furnished on application. M. B. ADAMS, Col. Engrs. Sept. 14.

SEALED PROPOSALS will be received at the office of the Light-House Board, Washington, D. C., until 2 o'clock p. m., Sept. 14, 1905, and then opened, for furnishing the materials and labor of all kinds necessary for the construction and delivery of the twin-screw steel steam light-house tender Sunflower, in accordance with specifications, copies of which, with blank proposals and other information, may be had upon application to REAR ADMIRAL B. P. LAMBERTON, U. S. N., Chairman.

U. S. ENGINEER OFFICE, 57 Park St., Grand Rapids, Mich., Sept. 4, 1905. Sealed proposals for extension of Piers at Holland (Black Lake), Mich., will be received here until 3 p. m., October 4, 1905, and then publicly opened. Information furnished on application. M. B. ADAMS, Col. Engrs. Sept. 28

FOR SALE.

For Sale.

Fore and aft Compound Marine Engine, size 6 x 12 x 6, and in perfect condition. Built by the Marine Iron Works, Chicago. Inquire of H. B. Larsen, Manistee, Mich.

FOR SALE.

Grab Bucket.

FOR SALE.—One "Hulett" two-rope clam-shell bucket. Slightly used. Address Box 82, Marine Review, Cleveland.

Marine Boiler.

For Sale.—One 50 H. P. Scotch Marine Boiler, 10 ft. long, 78 in. diameter, 160 lbs. steam pressure. Manufactured by Ritter & Co., Buffalo, N. Y. In first-class shape. For particulars, write The Detroit Stove Works, Detroit, Mich. t. f.

FOR SALE.

GASOLINE DELIVERY BOAT "I-NO-U."

Hull 38½ ft. long and 8½ ft. beam. Built very heavy and in the best manner possible. Keel 5¼ in. x 10½ in. Frames 2 in. x 3 in. at bottom and 2 in x 2 in. at top.

Planked and ceiled with 1⅛ in oak.

Lacy Bros. 15-H. P. engine. Throws a 34 in. two-bladed reversible wheel 300 revolutions per minute and runs 8½ miles per hour. Nicely modeled boat and handles well. This is her second season and she is nearly as good as new. Lowest cash price $1,800. Photo on application, but she should be seen to be appreciated.

THE HARDY & DISCHINGER CO.
Oils and Supplies,
TOLEDO, - OHIO.

FOR SALE.

FOR SALE $3500.00.

The Steamer Gordon Campbell.

Burned on spar-deck, forward only—easy to cut down to lumber barge, to carry million feet. Machinery, boilers and hull untouched and in good condition. Boat in dry dock and thoroughly overhauled last summer. Can be seen in Chicago. Address Room 613, 59 Dearborn St., Chicago. t f

Tug for Sale.

Tug Kate for sale cheap at one-third of her actual cost. Sixty-three ft. keel, 16 ft. beam, 7 ft. draught. Engine 16 x 18; A1 boiler. Easy on fuel. Has winch for hauling in tow line and closing rafts. Full equipment. Just laid up. Snap for some one. JOSEPH GANLEY, Agent, Sault Ste. Marie, Mich.

McMyler Derricks.

Several second-hand whirley derricks for sale. Adress Box 83, Marine Review, Cleveland.

Steam Capstans.

Two steam capstans in perfect condition for sale. Installed but never used. Address Box 81, Marine Review, Cleveland.

Ritchie Liquid Compass

The Standard Liquid Compass used exclusively by the U. S. Navy for over 35 years. Over 25,000 used in Merchant Service.

Made in all sizes and styles, from 2 to 12 inches diameter of card. All compasses made by us have our name printed below the North point or prominently upon the card. **None other are genuine.** Latest form with four or six needles, the best instrument for iron ships. For sale by ship chandlers and nautical instrument dealers. Catalogue free.

E. S. RITCHIE & SONS, Brookline, Mass., U. S. A.
MANUFACTURERS OF NAUTICAL AND PHYSICAL APPARATUS.

SAFETY AT SEA

in time of danger depends upon the closure of the ship's bulkhead doors. A long series of maritime disasters shows that this can only be accomplished by means of

THE "LONG-ARM" SYSTEM

By this system, consisting of a central emergency station from which power doors and hatch-plates are unfailingly controlled, the electric motor does the work, leaving nothing to chance or individual initiative and bravery. Adopted after searching tests for use on 36 vessels of the United States Navy. *Further information may be obtained from*

The "Long-Arm" System Co., Cleveland, O.

SHIPMATE RANGES

8 sizes. 11 styles

A range that does its work well.

If you have a poor range in your galley, you are quite as likely to get into a terrible stew yourself as you are to have a good stew for dinner.

With a Shipmate range you can "lay a true course" for good cooking. They are sold on the Lakes by

Bean, Schermerhorn & Co , 69 Main St., Buffalo,
R. T. Mitchell, 64 Prospect St., Cleveland,
The T R. Rayl Co., 112-116 Woodward Ave., Detroit,
J. B. Sperry, Port Huron
Geo. B. Carpenter & Co., 202-208 So. Water St., Chicago,
Lott, Burton & Co., 86 Lake St., Chicago,
John Black, 81-170 92nd St., South Chicago.

MADE BY

THE STAMFORD FOUNDRY COMPANY, STAMFORD, CONN.

Buyers' Directory of the Marine Trade.—*Continued.*

ELECTRIC LIGHT AND POWER PLANTS.

General Electric Co.......Schenectady, N. Y.
Mietz, Aug.......................New York.
Sturtevant, B. F. & Co......Hyde Park, Mass.
Thropp & Sons, John E.......Trenton, N. J.

ENGINE BUILDERS, MARINE.

American Ship Building Co........Cleveland.
Atlantic Works..........East Boston, Mass.
Chicago Ship Building Co..........Chicago.
Chase Machine Co.................Cleveland.
Cramp, Wm. & Sons............Philadelphia.
Craig Ship Building Co...........Toledo, O.
Detroit Ship Building Co.............Detroit.
Fletcher, W. & A. Co.........Hoboken, N. J.
Fore River Shipbuilding Co....Quincy, Mass.
Great Lakes Engineering Works.Detroit, Mich.
Hall Bros. ....Philadelphia.
Lockwood Mfg. Co.........East Boston, Mass.
Marine Iron Works.................Chicago.
Maryland Steel Co.......Sparrows Point, Md.
Mietz, Aug........................New York.
Milwaukee Dry Dock Co..........Milwaukee.
Mosher, Chas. D..................New York.
Moulton Steering Engine Co.......New York.
Newport News Ship Building Co.........
.....................Newport News, Va.
New York Shipbuilding Co....Camden, N. J.
Northwestern Steam Boiler & Mfg. Co...
.... Duluth, Mich.
Quintard Iron Works Co...........New York.
Roach's Ship Yard..............Chester, Pa.
Sheriffs Mfg. Co..................Milwaukee.
Superior Ship Building Co....Superior, Wis.
Thropp, J. E. & Sons Co......Trenton, N. J.
Trout, H. G.........................Buffalo.

ENGINE BUILDERS, STEAM.

Sturtevant Co , B. F...........Hyde Park, Mass.

ENGINE ROOM TELEGRAPH, CALL BELLS, ETC.

Cory, Chas. & Son................New York.
Marine Mfg. Supply Co............New York.

ENGINE TESTING.

Parsons, Ralph M......................... Chicago.

ENGINEERING SPECIALTIES AND SUPPLIES.

Crane Co. ....Chicago.
Kieley & Mueller ....New York.
Lunkenheimer Co. ....Cincinnati.
Northwestern Steam Boiler & Mfg. Co...
.... Duluth, Minn.

ENGINEERS, MARINE, MECHANICAL, CONSULTING.

Hynd, Alexander ....Cleveland.
Hunt, Robt. W. & Co................Chicago.
Kidd, Joseph..................Duluth, Minn.
Mosher, Chas. D..................New York.
Nacey, James ....Cleveland.
Roelker, H. B. ....New York.
Wood, W. J. ....Chicago.

FANS FOR VENTILATION, EXHAUST, ETC.

Sturtevant, B. F. Co........Hyde Park, Mass.

FEED WATER PURIFIERS AND HEATERS.

Greacen-Derby Engineering Co.............
.......................Perth Amboy, N. J.
Ross Valve Co.....................Troy, N. Y.

FIRE EXTINGUISHERS.

Safety Fire Extinguisher Co.......New York.

FIXTURES FOR LAMPS, OIL OR ELECTRIC.

General Electric Co.......Schenectady, N. Y.

FORGES.

Sturtevant, B. F. Co.................Boston.
Sutton Co., C. E..................Toledo, O.

FORGINGS FOR CRANK, PROPELLER OR THRUST SHAFTS, ETC.

Cleveland City Forge & Iron Co...Cleveland.
Fore River Shipbuilding Co.....Quincy, Mass.
Macbeth Iron Co.................Cleveland.

FLUE WELDING.

Fix's, S. Sons.....................Cleveland.

FUEL ECONOMIZERS.

Sturtevant Co., B. F........Hyde Park, Mass.

FUELING COMPANIES AND COAL DEALERS.

Hanna, M. A. & Co..............Cleveland.
Ironville Dock & Coal Co..........Toledo, O.
Parker Bros. Co., Ltd..............Detroit.
Pickands, Mather & Co............Cleveland.
Pittsburg Coal Co.................Cleveland.
Smith, Stanley B., & Co............Detroit.
Smith Coal & Dock Co., Stanley B. Toledo, O.

FUELING PLANTS, BUILDERS OF

Link Belt Machinery Co............Chicago.

FURNACES FOR BOILERS.

Continental Iron Works..........New York.

GAS BUOYS.

Safety Car Heating & Lighting Co..New York.

GAS AND GASOLINE ENGINES.

Chase Machine Co................Cleveland.

GAUGES, STEAM AND VACUUM.

Ashton Valve Co....................Boston.
Lunkenheimer Co. ....Cincinnati.

GAUGES, WATER.

Bonner Co., Wm. T...................Boston.
Lunkenheimer Co. ....Cincinnati, O.

GENERATING SETS.

Sturtevant Co., B. F........... Hyde Park, Mass.
General Electric Co...........Schenectady, N. Y.

GRAPHITE.

Dixon Crucible Co., Joseph..Jersey City, N. J

GREASE EXTRACTORS.

Greacen-Derby Engineering Co.............
.......................Perth Amboy, N. J.

HAMMERS, STEAM.

Chase Machine Co................Cleveland.

HEATING APPARATUS.

Sturtevant, B. F. Co......Hyde Park, Mass.
Sutton Co., C. E..................Toledo, O.

HOISTS FOR CARGO, ETC.

American Ship Building Co........Cleveland.
Brown Hoisting Machinery Co. (Inc.)....
................................Cleveland.
Chase Machine Co................Cleveland.
General Electric Co..............New York.
Georgian Bay Engineering Works........
.........................Midland, Ont.
Hyde Windlass Co..................Bath, Me.
McMyler Mfg. Co..................Cleveland.
Marine Iron Co......................Bay City.
Mietz, Aug. ....New York.

HOLLOW SHAFTINGS, IRON OR STEEL.

Falls Hollow Staybolt Co...Cuyahoga Falls, O.

HOLLOW STAYBOLT IRON.

Falls Hollow Staybolt Co...Cuyahoga Falls, O.

HYDRAULIC DREDGES.

Great Lakes Engineering Works......Detroit.

HYDRAULIC TOOLS.

Watson-Stillman Co., The.........New York.

ICE MACHINERY.

Great Lakes Engineering Works......Detroit.
Roelker, H. B...................New York.

INDICATORS FOR STEAM ENGINES.

Ashton Valve Co.....................Boston.

INJECTORS.

American Injector Co...............Detroit.
Crane Co. ....Chicago.
Jenkins Bros. ....New York.
Lunkenheimer Co..................Cincinnati.
Penberthy Injector Co.........Detroit, Mich.

INSURANCE, MARINE.

Elphicke, C. W. & Co...............Chicago.
Fleming & Co., E. J.................Chicago.
Gilchrist & Co., C. P..............Cleveland.
Hawgood & Co., W. A...............Cleveland.
Helm & Co., D. T...................Duluth.
Hutchinson & Co....................Cleveland.
McCarthy, T. R....................Montreal.
McCurdy, Geo. L....................Chicago.
Mitchell & Co......................Cleveland.
Parker Bros. Co., Ltd...............Detroit.
Peck, Chas. E. & W. F..New York & Chicago.
Prindiville & Co....................Chicago.
Richardson, W. C..................Cleveland.
Sullivan, D. & Co...................Chicago.

IRON CASTINGS.

Sutton Co., C. E...................Toledo, O.

IRON ORE AND PIG IRON.

Bourne-Fuller Co.............Cleveland, O.
Hanna, M. A. & Co.............Cleveland.
Pickands, Mather & Co............Cleveland.

LAUNCHES—STEAM, NAPHTHA, ELECTRIC.

Marine Iron Works................Chicago.
Truscott Boat Mfg. Co.....St. Joseph, Mich.

LIFE PRESERVERS, LIFE BOATS, BUOYS.

Armstrong, Cork Co...............Pittsburg.
Drein, Thos. & Son.........Wilmington, Del.
Gaynor, T. F ....New York.
Kahnweiler's Sons, D..............New York.
National Cork Co.....................Brooklyn.

LIGHTS, SIDE AND SIGNAL.

Russell & Watson ....Buffalo.

LOGS.

Nicholson Ship Log Co............Cleveland.
Walker & Sons, Thomas....Birmingham, Eng.
Also Ship Chandlers.

LUBRICATING GRAPHITE.

Dixon Crucible Co., Joseph..Jersey City, N. J.

LUBRICATORS.

Crane Co.............................Chicago.
Lunkenheimer Co. ....Cincinnati

LUMBER.

Martin-Barriss Co...................Cleveland.
Rayner, J. ....Chicago.

MACHINISTS.

Chase Machine Co..................Cleveland.
Hickler Bros.........Sault Ste. Marie, Mich.
Lockwood Mfg. Co........East Boston, Mass.

MACHINE TOOLS (WOOD WORKING).

Atlantic Works, Inc.............Philadelphia.

MARINE RAILWAYS.

Hickler Bros..........Sault Ste. Marie, Mich.

MARINE RAILWAYS, BUILDERS OF.

Crandall & Son, H. I.....East Boston, Mass.

MATTRESSES, CUSHIONS, BEDDING.

Fogg, M. W.....................New York.

MECHANICAL DRAFT FOR BOILERS.

American Ship Building Co........Cleveland.
Detroit Ship Building Co.............Detroit.
Great Lakes Engineering Works......Detroit.
Sturtevant, B. F. Co.......Hyde Park, Mass.

METALLIC PACKING.

Katzenstein, L. & Co.............New York.

MOTORS, GENERATORS—ELECTRIC

General Electric Co.......Schenectady, N. Y.
Sturtevant, B. F. Co.......Hyde Park, Mass.

NAUTICAL INSTRUMENTS.

Ritchie, E. S., & Sons......Brookline, Mass.

NAVAL ARCHITECTS.

Hynd, Alexander ....Cleveland.
Kidd, Joseph ....Duluth, Minn.
Mosher, Chas. D.............New York.
Nacey, James ....Cleveland.
Wood, W. J. ....Chicago.

OAKUM.

Stratford, Oakum Co.......Jersey City, N. J.

OIL ENGINES.

Mietz, Aug. ....New York.

OILS AND LUBRICANTS.

Dixon Crucible Co., Joseph..Jersey City, N. J.
Standard Oil Co..................Cleveland.

PACKING.

Crane Co. ....Chicago.
Jenkins Bros. ....New York.
Katzenstein, L. & Co..............New York.

PAINTS.

Baker, Howard H. & Co............Buffalo.
Upson-Walton Co. ....Cleveland.

PATTERN SHOP MACHINERY.

Atlantic Works, Inc............Philadelphia.

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PILE DRIVING AND SUBMARINE WORK.

Buffalo Dredging Co................Buffalo.
Dunbar & Sullivan Dredging Co.....Buffalo.
Fitz-Simons & Connell Co............Chicago.
Great Lakes Dredge & Dock Co.....Chicago.
Hickler Bros.........Sault Ste. Marie, Mich.
Hubbell Co., H. W...............Saginaw, Mich.
Lake Superior Contracting & Dredging Co. .... Duluth, Minn.
Parker Bros. Co., Ltd..................Detroit.
Smith Co., L. P. & J. A..........Cleveland.
Starke Dredge & Dock Co., C. H..Milwaukee.
Sullivan, M......................... Detroit

PIPE, WROUGHT IRON.

Bourne-Fuller Co...............Cleveland, O.
Crane Co. ....Chicago.
Macbeth Iron Co..................Cleveland.
Reading Iron Co..............Reading, Pa.

PLANING MILL MACHINERY.

Atlantic Works, Inc............Philadelphia.

PLATES—SHIP, STRUCTURAL, ETC.

Bourne-Fuller Co..............Cleveland, O.
Otis Steel Co......................Cleveland.

PRESSURE REGULATORS.

Kieley & Mueller ....New York.
Ross Valve Co...................Troy, N. Y.

PROPELLER WHEELS.

American Ship Building Co........Cleveland.
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Cramp, Wm. & Sons............Philadelphia.
Detroit Ship Building Co.............Detroit.
Fore River Shipbuilding Co.....Quincy, Mass.
Great Lakes Engineering Works......Detroit.
Hyde Windlass Co................Bath, Me.
Lockwood Mfg. Co. ....East Boston, Mass.
Marine Iron Works.................Chicago.
Milwaukee Dry Dock Co.........Milwaukee.
Newport News Ship Building Co. ....Newport News, Va.
Roelker, H. B.....................New York.
Sheriffs Mfg. Co....................Milwaukee.
Superior Ship Building Co....Superior, Wis.
Thropp & Sons Co., J. E.....Trenton, N. J.
Trout, H. G.........................Buffalo.

PROJECTORS, ELECTRIC.

General Electric Co.......Schenectady, N. Y.

PUMPS FOR VARIOUS PURPOSES.

Great Lakes Engineering Works......Detroit.
Marine Iron Works.................Chicago.
Kingsford Foundry & Machine Works.... ....Oswego, N. Y.

PUNCHES AND SHEARS.

Sutton Co., C. E..................Toledo, O.

RANGES.

Stamford Foundry Co........Stamford, Conn.

REFRIGERATING APPARATUS.

Great Lakes Engineering Works.......Detroit.
Roelker, H. B....................New York.

REGISTER FOR CLASSIFICATION OF VESSELS.

Great Lakes Register.............Cleveland.

RIVETS, STEEL FOR SHIPS AND BOILERS.

Bourne-Fuller Co...............Cleveland, O.

SAFETY VALVES.

Ashton Valve Co....................Boston.
Crane Co. ....Chicago.
Lunkenheimer Co. ....Cincinnati.

SAIL MAKERS.

Baker, Howard H. & Co.............Buffalo.
Upson-Walton Co...................Cleveland.

SALVAGE COMPANIES.

See Wrecking Companies.

SEARCH LIGHTS.

General Electric Co........Schenectady, N. Y.

SHAFTING, HOLLOW.

Falls Hollow Staybolt Co..Cuyahoga Falls, O.

SHEARS.

See Punches, and Shears.

SHIP AND BOILER PLATES AND SHAPES.

Bourne-Fuller Co.............Cleveland, O.
Otis Steel Co.....................Cleveland.

SHIP BUILDERS.

American Ship Building Co........Cleveland.
Atlantic Works ....East Boston, Mass.
Buffalo Dry Dock Co................Buffalo.
Cramp, Wm. & Sons...........Philadelphia.
Craig Ship Building Co...........Toledo, O.
Chicago Ship Building Co............Chicago.
Detroit Ship Building Co.............Detroit.
Fore River Shipbuilding Co.....Quincy, Mass.
Great Lakes Engineering Works......Detroit.
Lockwood Mfg. Co.........East Boston, Mass.
Manitowoc Dry Dock Co........Manitowoc, Wis.
Maryland Steel Co.........Sparrows Point, Md.
Milwaukee Dry Dock Co..........Milwaukee.
Newport News Ship Building Co......... ....Newport News, Va.
New York Shipbuilding Co....Camden, N. J.
Roach's Ship Yard..............Chester, Pa.
Shipowner's Dry Dock Co...........Chicago.
Smith & Son, Abram..........Algonac, Mich.

SHIP CHANDLERS.

Baker, Howard H. & Co............Buffalo.
Marine Mfg. & Supply Co..........New York.
Upson-Walton Co.................Cleveland.

SHIP DESIGNERS.

Kidd, Joseph ....Duluth.
Steel, Nacey & Hynd..............Cleveland.
Wood, W. J.......................Chicago.

SHIP LANTERNS AND LAMPS.

Russell & Watson...................Buffalo.

SHIPMATE RANGES.

Stamford Foundry Co........Stamford, Conn.

SHIP TIMBER.

Martin-Barriss Co..................Cleveland.
Rayner, J. ....Chicago.

SMOOTH-ON COMPOUND, FOR REPAIRS.

Smooth-On Mfg. Co.......Jersey City, N. J.

STAYBOLT IRON OR STEEL BARS, HOLLOW OR SOLID.

Falls Hollow Staybolt Co..Cuyahoga Falls, O.

STEAM VESSELS FOR SALE.

Gilchrist & Co., C. P.............Cleveland.
Holmes, Samuel ....New York.
Lester, S. S...................Quebec, Can.
McCarthy, T. R..............Montreal, Can.

STEAMSHIP LINES, PASS. AND FREIGHT.

American Line ....New York.
Anchor Line ....Buffalo.
Boston Steamship Co................Boston.
Cleveland & Buffalo Transit Co....Cleveland.
International Mercantile Marine Co...... .... Philadelphia.
Mallory Line ....New York.
Merchants' Montreal Line..........Montreal.
New York & Cuba Mail S. S. Co...New York.
Red Star Line....................New York.
United Fruit Co.....................Boston

STEEL CASTINGS.

Otis Steel Co......................Cleveland.
Sutton Co., C. E..................Toledo, O.

STEERING APPARATUS.

American Ship Building Co.........Cleveland.
Chase Machine Co.................Cleveland.
Detroit Ship Building Co.............Detroit.
Hyde Windlass Co.................Bath, Me.
Marine Mfg. & Supply Co.........New York.
Moulton Steering Engine Co.......New York.
Sheriffs Mfg. Co...................Milwaukee.

SUBMARINE DIVING APPARATUS.

Morse & Son, A. J..................Boston.
Schrader's Son, Inc., A...... ....New York.

SURVEYORS, MARINE.

Gaskin, Edward ....Buffalo.
Hynd, Alexander ....Cleveland.
Parker Bros. Co., Ltd................Detroit.
Nacey, James ....Cleveland.
Steel, Adam ....Cleveland.
Wood, W. J.........................Chicago.

TESTS OF MATERIALS.

Hunt, Robert W. & Co.............Chicago.
Lunkenheimer Co.............Cincinnati, O.

TOOLS, METAL WORKING, FOR SHIP AND ENGINE WORKS.

Watson-Stillman Co...............New York.

TOOLS, WOOD WORKING.

Atlantic Works, Inc............Philadelphia.

TOWING MACHINES.

American Ship Windlass Co..Providence, R. I.
Chase Machine Co................Cleveland.

TOWING COMPANIES.

Donnelly Salvage & Wrecking Co........ ....Kingston, Ont.
Great Lakes Towing Co............Cleveland.

TRAPS, STEAM.

Kieley & Mueller ....New York.
Sturtevant Co., B. F.......Hyde Park, Mass.

TRUCKS.

Boston & Lockport Block Co.........Boston.

TUBING, SEAMLESS.

Shelby Steel Tube Co.........Pittsburg, Pa.

VALVES, STEAM SPECIALTIES, ETC.

Ashton Valve Co.....................Boston.
Crane Co. ....Chicago.
Jenkins Bros. ....New York.
Kieley & Mueller..................New York.
Lunkenheimer Co...................Cincinnati.
Ross Valve Co...................Troy, N. Y.

VALVES FOR WATER AND GAS.

Lunkenheimer Co..................Cincinnati.
Ross Valve Co...................Troy, N. Y.

VARNISHES.

Detroit Varnish Co....................Detroit.
Detroit White Lead Works..........Detroit.
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Sutton Co., C. E..................Toledo, O.

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Fleming & Co., E. J.................Chicago.
Gilchrist & Co., C. P...............Cleveland.
Hall, John B..........................Buffalo.
Helm & Co., D. T....................Duluth.
Hawgood & Co., W. A.............Cleveland.
Holmes, Samuel ....New York.
Hutchinson & Co...................Cleveland.
Lester, S. S. ....Quebec, Can.
McCarthy, T. R....................Montreal.
Mitchell & Co......................Cleveland.
Parker Bros. Co., Ltd................Detroit.
Prindiville & Co.....................Chicago.
Richardson, W. C..................Cleveland.
Sullivan, D. & Co...................Chicago.

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Hyde Windlass Co.................Bath, Me.
Marine Mfg. & Supply Co........New York.

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Georgian Bay Engineering Works........ ....Midland, Ont.
Hyde Windlass Co.................Bath, Me.

WOOD WORKING MACHINERY.

Atlantic Works, Inc............Philadelphia.

WOODS, FOREIGN.

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WRECKING AND SALVAGE COMPANIES.

Donnelly Salvage & Wrecking Co........ ....Kingston, Ont.
Great Lakes Towing Co............Cleveland.
Parker Bros. Co., Ltd...............Detroit.

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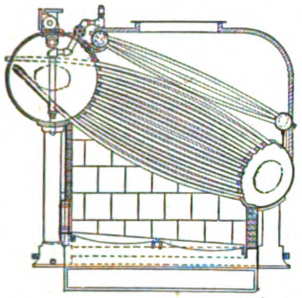

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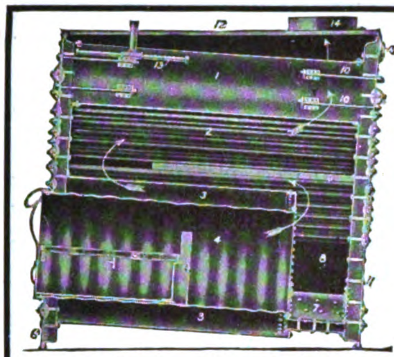

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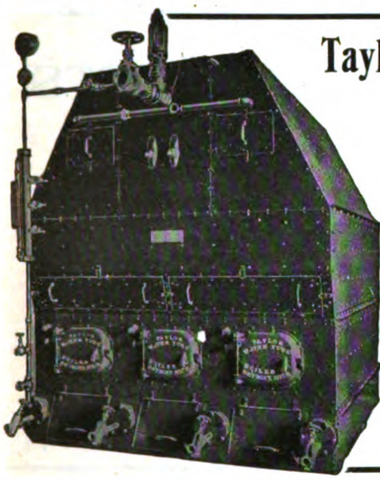

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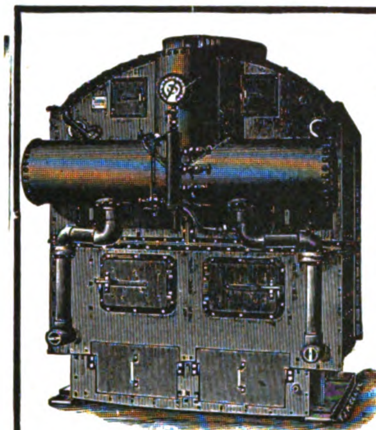

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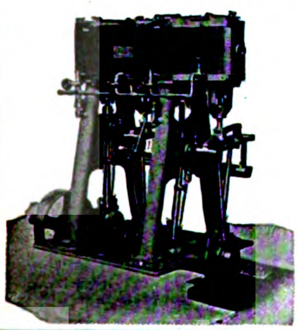

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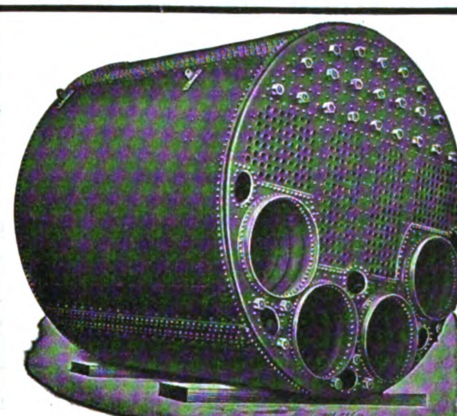

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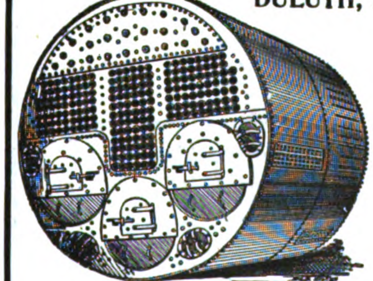

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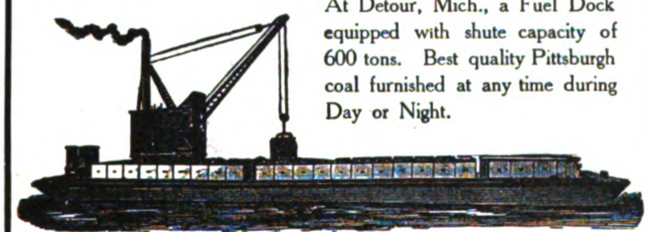

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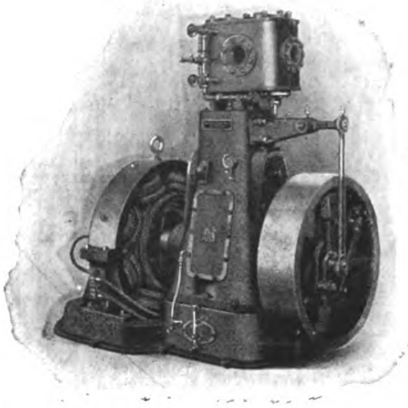

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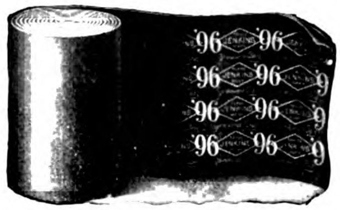

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